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Stabilization Investigation

Former CIBA-GEIGY Facility
Cranston, Rhode Island

Revised Final Stabilization Design Documents
Operation and Maintenance Manual

Prepared For:
CIBA-GEIGY Corporation
Route 37 West
Toms River, New Jersey 08754

Prepared By:
Woodward-Clyde Consultants
201 Willowbrook Boulevard
Wayne, New Jersey 07470

Volume 3 of 4

January 1995
Project No. 87X4660D

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VOLUME 3

1.0
INTRODUCTION

CIBA-GEIGY Corporation (CIBA-GEIGY) has retained the services of Woodward-Clyde Consultants, Inc. to prepare this Operation and Maintenance (O&M) Manual for the groundwater capture, groundwater pretreatment, and soil vapor extraction (SVE) systems at the former CIBA-GEIGY facility in Cranston, Rhode Island. The O&M manual is organized into the following seven sections:

Section 1	-	Introduction
Section 2	-	Safety Policies and Procedures
Section 3	-	System Description
Section 4	-	System Operation and Potential Operating Problems
Section 5	-	Maintenance and Repair
Section 6	-	Sampling/Laboratory Testing
Section 7	-	Functional Specification

Only preliminary versions of the above sections have been prepared at this time, since the required equipment has not been purchased. As a result, specific operation and maintenance information is currently not available and complete operating and maintenance procedures can not be developed at this time. Also, CIBA-GEIGY plans to perform a process safety review on the Final Stabilization Design Documents (FSDD) prior to advertizement for bid. Recommendations developed during this review could also impact several sections of this document.

As equipment is purchased for all three stabilization systems, the O&M manual will be refined and further developed. During start-up of the systems, the O&M manual will be confirmed and revised accordingly. A final O&M manual will be issued following construction.

2.1 OVERVIEW

The policies and procedures presented herein are designed to:

- reduce the risk of employee injury and occupational illness;
- satisfy regulatory requirements regarding health and safety; and
- satisfy CIBA-GEIGY Corporation (CIBA-GEIGY) health and safety requirements.

All personnel involved with the groundwater capture, groundwater pretreatment, and soil vapor extraction systems (the "Facility") are required to comply with these policies and procedures. CIBA-GEIGY expects this commitment to the health and safety program from their employees and failure to comply may result in disciplinary action.

2.2 PROGRAM ORGANIZATION

For this project, the responsibilities of the WCC Project Manager and Site Safety Officer related to health and safety are as follows.

2.2.1 Project Manager

2.2.1.1 Responsibilities

- Assures that projects are performed in a manner consistent with current Ciba-Geigy Health and Safety Programs;

- Assures that project Health and Safety Plans are prepared, approved, and properly implemented;

- Implements Health and Safety Plans;

- Assures that adequate funds are allocated to fully implement project health and safety; and

- Coordinates with the Project Health and Safety Officer on health and safety matters.

2.2.2.2 Authority (Safety Related)

- Assigns a Health and Safety Officer-approved Site Safety Officer to the project and, if necessary, assigns a suitably qualified replacement;

- Suspends field activities if health and safety of personnel are endangered, pending an evaluation by the Project Health and Safety Officer and/or Corporate Health and Safety Manager; and

- Suspends an individual from field activities for infractions of the Health and Safety Plan, pending an evaluation by the Project Health and Safety Officer and/or the Corporate Health and Safety Manager.

2.2.2 Site Safety Officer

2.2.2.1 Responsibilities

- Directs health and safety activities on-site;

- Reports immediately all safety related incidents or accidents to the Project Health and Safety Officer and Ciba-Geigy Project Manager;

- Assists Ciba-Geigy Project Manager in all aspects of implementing Health and Safety Plans;

- Maintains health and safety equipment on-site; and

- Implements emergency procedures as required.

2.2.2.2 Authority

- Temporarily suspends field activities if health and safety of personnel are endangered, pending an evaluation by the Project Health and Safety Officer and/or Corporate Health and Safety Manager; and

- Temporarily suspends an individual from field activities for infractions of a Health and Safety Plan, pending an evaluation by the Project Health and Safety Officer and/or Corporate Health and Safety Manager.

The Ciba-Geigy Project Manager has overall responsibility for site safety; the Site Safety Officer has day-to-day responsibilities for monitoring and directing the program. The health and safety related responsibilities and authority of other members of the project team are described in the Health and Safety Manual.

2.2.3 Other Personnel

All CIBA-GEIGY and other field personnel must remain conscious of their safety responsibilities and comply with all the policies, procedures, and permits applicable to the ongoing work. Safety responsibilities of individual workers include the following:

- performing every job in a safe manner for the benefit of self, co-workers, contractors, and the protection of facilities;

- immediately reporting every injury, regardless of severity;

- reporting unsafe conditions and practices to a supervisor and correcting where possible;

- participating in safety meetings and training;

- assisting in reporting and investigating incidents, injuries, and serious potential incidents; and

- reviewing and becoming familiar with the contents of this and other pertinent safety manuals, handbooks, and publications.

2.3 GENERAL SAFETY RULES

The following general safety rules must be reviewed, implemented, and strictly adhered to, by all workers, as appropriate:

- Immediately report all injuries or incidents to a supervisor. Attend to the injured or ill employee.

- All fires or spills or leaks of hazardous materials must be reported immediately to a supervisor.

- All unsafe conditions must be reported to a supervisor. Unsafe equipment must be tagged with "DANGER - DO NOT OPERATE" tags.

- Whenever a safety device is disabled, removed from service, and/or defeated, a supervisor must be notified and the device tagged.

- All visitors must be authorized by the proper site representatives before entering or doing any work at the Facility.

- Do not operate equipment for which you are not qualified.

- Horseplay or fighting on premises is prohibited.

- Smoking is permitted in designated areas only. Eating or drinking is prohibited in the operating areas of the Facility.

- The use, possession, transportation or sale of illegal drugs, alcoholic beverages, fire arms, deadly weapons, or explosives on the premises is prohibited.

- Use handrails and step one step at a time when ascending or descending stairs. Running is not allowed in the Facility.

- When lifting loads manually, use proper lifting techniques such as bending knees, obtaining assistance, and mechanical lifting aids.

- Erect barricades around areas of hazardous work, such as holes in decking/flooring and work areas, trenches, or overhead activities, Only the person in charge may grant permission for entry into these areas.

- Work platforms, approved scaffolding, ladders, or safety harnesses must be used if the work height is greater than 6 feet from ground level. Any high elevation (greater than 6 foot) work must be done in a protected work platform with handrails, midrails, kick plates, and flooring or the worker must be protected from fall with a safety harness.

- All personnel, including visitors and contractors, are required to wear hard hats and safety glasses with side shields while in the Facility and not in a building providing overhead protection.

- General footwear consisting of substantial shoes or boots with ANSI approved steel toes must be worn in the Facility. More protective footwear may be required in particular areas or for specific jobs.

- Hearing protection is required when the noise level exceeds 85 dBA.

- If clothing becomes contaminated, the clothing must be removed as soon as possible.

- Personal protective equipment will be assigned and worn by personnel performing work requiring such equipment. Personal protective equipment will be consistent with the Material Safety Data Sheets when handling hazardous materials.

- Use only proper tools and equipment maintained in good working condition.

- Fire extinguishers, alarm boxes, fire doors, eyewash stations, first aid kits, and all other emergency equipment must be in good condition, inspected regularly, and kept clear of obstructions.

- All block valves on pressure relief systems must be locked or sealed open.

- Operation of equipment having a "DANGER - DO NOT OPERATE" tag is prohibited.

- Under normal operations, all operating machinery and electrical switch gear must have all required safety guards, switches, and alarms in place and functional.

- When transferring flammable or combustible liquids into metal containers, the metal containers must be grounded.

- Any operation of equipment outside the limits (temperature, pressure, flow) described in the Operation and Maintenance Manual will only be performed with written authorization of the Ciba-Geigy Project Manager.

2.4 SAFETY STANDARDS

2.4.1 Hot Work Procedures

The following procedures apply to maintenance or other tasks that are capable of producing a source of ignition and which are not directly connected with or controlled by normal operational activities. In general, hot work procedures are applicable to tasks involving sources of ignition and where flammable gas or vapor may exist.

Potential sources of ignition include:

- Welding and cutting
- Open flames
- Hot tapping
- Portable heaters
- Internal combustion engines
- Portable electrical tools
- Grinding
- Drilling
- Chipping
- Soldering
- Sandblasting
- Thawing frozen pipes
- Freeing seized bearings

Due to the numerous operations involving flammable materials which may be performed, it is impossible to list every situation or area capable of producing flammable vapors. However, the follow areas should always be considered hazardous:

- Soil Vapor Extraction System;
- Pipeline manifolds and pumps;
- Tanks and diked area; and
- Laboratories and sample storage facilities.

The following general precautions should be followed, as appropriate, when performing hot work:

- Do not perform hot work unless absolutely necessary. Consideration should be given to relocation the work to a safe area whenever possible.

- Hot work shall be done under the supervision of persons who understand the fire and explosion potential. The hot work will be performed by personnel sufficiently skilled to carry out the associated operations.

- Contracts should be made only with contractors who acknowledge understanding of hot work procedures and agree to have their employees abide by them. It is the Ciba-Geigy Project Manager's responsibility to maintain liaison with the contractor on all matters relating to fire prevention.

- Always monitor the area with a combustible gas indicator before starting hot work and while work is in progress. Combustible gas indicators must be calibrated with a suitable calibration gas prior to use.

- Keep fire extinguishers and other appropriate fire fighting equipment close by. If applicable, designate a person as fire watcher to extinguish small fires. The job site should be observed for at least 30 minutes after completion of the work to be sure that no hot spots remain.

- All bystanders must be out of the area of exposure.

- Detailed planning is essential. The supervisor in charge should review the work to be done with maintenance personnel, describing pertinent safety and fire prevention measures to be taken.

Before allowing hot work to start, the supervisor in charge should verify that the following applicable conditions have been met:

- piping connections have been blinded off or a section of pipe removed;

- valves are tagged and locked out;

- switches are tagged and locked out at breaker panel;

- vessel or pipe are depressurized;

- fire extinguishers are available;

- fire watches have been designated;

- flammable gas test has been made and additional tests will be made while the work is in progress; and

- vessel or pipeline have been vented and/or steamed, and are free of flammable gas.

An example of a Hot Work Permit is provided at the end of this section in Figure 2-1.

2.4.2 Lockout/Tagout Procedures

2.4.2.1 Scope

These procedures are required when an unexpected release of energy such as electrical, hydraulic, pneumatic, or mechanical could potentially cause injury to personnel. These procedures establish lockout/tagout procedures to prevent the unexpected release of energy.

An initial evaluation must be performed to identify potential exposures that must be isolated before safely working on equipment and appropriate affected personnel notified.

These procedures do not apply to minor tool adjustments or servicing activities that are routine, repetitive, and integral to operations.

2.4.2.2 Electrical Lockout/Tagout Procedures

Electrical lockout/tagout procedures must be used before commencing any work requiring personnel to work on or near de-energized circuit parts or equipment in any situation where there is danger of injury due to unexpected energization or startup of equipment.

- The person doing the work shall LOCK open the circuit breaker(s) or approved disconnect device.

- TAG the lockout with a dated and signed "DANGER-DO NOT OPERATE" tag. The reason for the lockout should be written on the tag.

- Other personnel working on this equipment will attach their lock and tag.

- Each lock will have only one key or a set of locks will have one key. The key will be held by the locking party until the job is completed.

- If a circuit cannot be locked out it must be de-energized and tagged. If the circuit requires disconnection or removal to ensure isolation, a qualified electrician must perform the work.

- The equipment will be tested at the on/off switch before beginning work after the locks are in place. This helps ensure that the right circuit has been locked out.

- Only the person(s) originally attaching the lock and tag is authorized to remove the lock and tag unless the person(s) is not available to remove the lock and tag. UNDER THESE CONDITIONS THE SUPERVISOR, AFTER CHECKING THE EQUIPMENT AND ASSUMING FULL RESPONSIBILITY, CAN REMOVE THE LOCK AND TAG AND PLACE THE EQUIPMENT IN SERVICE. The supervisor is responsible for notifying personnel that their lock(s) and tag(s) have been removed.

- Personnel unlocking equipment for energization are responsible to check with the work area to assure there is no hazard to personnel by starting/testing/re-energizing the equipment.

2.4.2.3 Process, Pneumatic, and Hydraulic Lockout/Tagout Procedures

Process, pneumatic, and hydraulic lockout/tagout procedures must be used before commencing any work requiring personnel to work on or near any energy sources such as process, hydraulic, or pneumatic fluids, or thermal or chemical systems where there is danger of injury due to the unexpected energization or startup of equipment.

The procedures for process, hydraulic and pneumatic lockout are essentially the same as the procedures for electrical lockout/tagout; the primary difference is in means of isolation.

Acceptable means of isolation in order of preference are as follows:

1. Blinding
2. Disconnection
3. Double block and bleed
4. Single block valve - valve must be locked closed
    - valve must not leak or have history of leaking
    - not acceptable for
        - high toxics
        - high pressure;
        - vessel entry; or
        - piping which will be open for extended periods of time.

2.4.2.4 Mechanical Energy Lockout/Tagout Procedures

- If springs are involved they must be released or physically restrained when necessary to immobilize mechanical equipment.

- The use of brakes is not an acceptable means of energy isolation. The use of blocks or chains in addition to the brake is required.

2.4.2.5 Review

At least annually, a documented review of all lockout/tagout procedures for the Facility must be conducted.

At a minimum, this review will include:

- identification of the equipment to which the procedure applies;
- the date of the review;
- a list of the employees reviewed; and
- the name of the supervisor conducting the review.

2.4.3 Confined Space Entry

This procedure establishes methods for preparation, entry, and restoration of a confined space to be entered by personnel. These procedures are designed to maintain a safe environment for personnel working in a confined space.

2.4.3.1 Scope

This procedure applies to excavations greater than 4 feet deep and to any confined space that is large enough to be entered bodily and has one or move of the following characteristics:

- limited or restricted openings for entry or exit;
- contains or has a potential to contain a hazardous atmosphere;
- is not intended for continuous occupation;
- has insufficient natural ventilation; or
- may contain known or potential hazards.

Confined spaces include, but are not limited to, storage tanks, frac tanks, tank trucks, process vessels, furnace boxes, sewer systems, ducts, flues, manholes, valve boxes, cellars, pipelines, pits, excavations, or other areas that may contain toxic, corrosive, flammable, oxygen deficient, or oxygen rich atmospheres.

Entry is defined as when any part of the entrants head breaks the plane of an opening into a confined space.

2.4.3.2 Pre-Entry Procedures

1. The space must first be isolated using the following techniques, as appropriate:

   - blinding of lines as near the space as possible;
   - disconnecting lines as near the space as possible; and
   - double block and bleed water and other non-hazardous lines.

A sketch of the space should be provided identifying the isolation and what technique was used to achieve isolation. <u>EVERY LINE MUST BE ISOLATED</u>.

2. Lockout all electrical sources to the space using the procedures outlined in the Electrical Lockout/Tagout Procedures.

3. The confined space must be cleared to remove vapors and contaminants from the space.

4. Establish and maintain ventilation to ensure movement of fresh air in the confined space.

5. The atmosphere in the confined space must be evaluated for the following:

   - Oxygen > 19.5 and < 23%
   - Flammable gases or vapors < 10% LEL
   - Toxic vapors - as necessary
   - Carbon monoxide < 5.0 ppm
   - Hydrogen sulfide < 1.0 ppm
   - Organic vapors < 25.0 ppm
   - Benzene < 1.0 ppm
   - Vinyl chloride < 1.0 ppm

   Calibrated instruments must be used to make these evaluations.

Verify with the Site Safety Officer which chemicals which should be measured in each particular confined space.

6. At least one properly trained and equipped "stand-by" person must be posted outside the confined space. This stand-by person's job is to maintain contact communication with workers in the confined space and to summon help should it be required. This person will not enter the confined space.

7. The need for a self-contained breathing apparatus (SCBA) or equivalent supplied air system shall be assessed by the Site Safety Officer. If determined to be necessary, it must be positioned, in complete working condition, outside the confined space.

8. Lifelines, harnesses, wristlets, or other appropriated retrieval equipment must be worn by entrants. A mechanical retrieving device must be available for vertical spaces more than 5 feet deep.

9. Equipment such as air movers and vacuum truck hoses shall be properly grounded or bonded to prevent static sparks. Any electrical equipment used in the confined space should either be 12 volt DC or be 120 VAC with ground fault interrupter (GFI).

10. Personal protective equipment such as coveralls, gloves, boots, safety glasses, and hard hat must be provided.

11. Personnel trained in first aid and CPR must be available at the site.

12. Appropriately sized fire extinguishers and other fire fighting equipment, if necessary, must be available.

13. A communication system must be established between the stand-by person and the entrants.

14. Signs and/or barricades must be posted outside the confined space.

15. Entrants and standby persons must be trained and familiar with the following:

    - assigned duties;
    - any hazardous material which may be present;
    - reserve equipment;
    - procedures and emergency contacts;
    - communication systems; and
    - personal protective equipment.

16. Rescue services and the method of communicating with rescue services must be listed on the permit.

17. A pre-entry safety meeting must be held to discuss all the above items including the specific confined space to be entered.

2.4.3.3 Entry Procedures

1. Entry may be made after all the items in Section 2.4.3.2 are completed and the confined space entry permit has been signed and issued. An example of a Confined Space Entry Permit is provided in Figure 2-2.

2. The stand-by person will remain in the stand-by position unless adequately relieved. Unauthorized persons will not be allowed entry.

3. The atmosphere inside the confined space will be continuously monitored and recording periodically made on the permit. If hot work is required in the confined space, a separate "Hot Work Permit" must be issued.

2.5 ELECTRICAL SAFETY

The following electrical safety requirements must be reviewed, implemented, and strictly adhered to by all workers, as appropriate:

- Only qualified and trained personnel are allowed to repair or install electrical equipment.

- All conductors are considered to be energized.

- CPR/first aid trained people must always be present at the Facility when electrical work is being performed.

- All circuits must be de-energized before beginning work. Refer to Lockout/Tagout Procedures in Section 2.4.2 for details of how to execute the lockout/tagout.

- Use suitable personnel protective equipment including rubber gloves, mats, and blankets to provide insulation from other elements which are energized or grounded. Rings, watches, or other metallic objects must not be worn while working on electrical equipment.

- Blown fuses shall be replaced only with the proper type and rating.

- Use of metal ladders is prohibited while working on or near electrical equipment or conductors.

- Never use defective electrical equipment.

- The use of field electrical equipment outdoors requires a GFI outlet.

- All power lines will be considered energized unless proper measures have been taken for de-energizing overhead power lines. Any part of the crane, boom, or machinery shall not be permitted within 20 feet of power lines.

2.6 EMERGENCY PROCEDURES

2.6.1 General

Emergency procedures must be available for emergency situations that could occur. Examples of situations requiring emergency procedures are fire, explosion, injury, spills of hazardous materials, toxic or combustible gas releases, or moving equipment accidents.

The Ciba-Geigy Project Manager is responsible for ensuring emergency procedures are available for all emergency situations that may arise during operation of the Facility.

All specific emergency procedures must contain the following common elements:

- internal/external communication;
- accountability for all employees; and,
- rescue procedures

2.6.2 Training Requirements

Facility personnel must be thoroughly trained as follows:

- Waste water operators and supervisors must be trained to Level 3 proficiency as described in the OSHA 29 CFR 1910.120 Regulations;

- Drills of the emergency plan will be performed every six months. Each drill execution will be followed by a critique and a written report distributed to the Project Manager and the Project Health and Safety Officer;

- Preparation of chain-of-custody forms;

- Response to medical, fire, or other emergencies;

- Evacuation routes; and

- Location and use of emergency equipment.

2.6.3 Site Communications

A site communication system will be established to warn all Facility personnel if an emergency occurs. This system must communicate the essentials needed for those individuals to protect themselves in an emergency. In addition, the communication system must be able to effectively notify all the required outside entities should an emergency occur.

Specific emergency procedures for the following must be developed:

- fire/explosion;
- medical emergency;
- toxic/flammable release to atmosphere; and
- spills of hazardous material.

2.7 COMPRESSED GAS CYLINDERS

2.7.1 General Safety Procedures

- Do not move or store cylinders without the protective cap over the valve.

- Move cylinders with a cart or carrier for cylinders and get help as necessary.

- Cylinders moved by a crane or derrick must be secured in a basket. Use of slings, ropes, or electromagnets is prohibited.

- Cylinders should not be allowed to strike each other and should only be used to contain gas.

- Threads on a regulator or fitting must correspond to those on the cylinder valve outlet.

- Always use a pressure reducing regulator on a cylinder unless the total system being discharged to is capable of handling the cylinder pressure.

- Never use oil or grease as a lubricant on valves or attachments to oxygen cylinders.

2.7.2 Storage of Cylinders

- Properly secure cylinders with chains, brackets, or ropes to prevent falling.

- Do not store oxygen cylinders within 20 feet of combustible gas cylinders. Adjacent storage can be accomplished provided a 5 foot or higher wall separates the cylinders and the wall has a fire rating of 30 minutes.

- Store cylinders in a safe, dry, well ventilated area.

- Store empty and full cylinders separate and each identified as full or empty.

2.8 INDUSTRIAL HYGIENE PROCEDURES

The objectives of these procedures are as follows:

- protect the health of personnel and the public;

- identify chemical stresses, physical and biological agents, and ergonomic hazards which can lead to occupational illnesses; and

- implement controls that prevent or minimize potential personnel exposures and/or illness.

Potential hazards at the Facility must be identified and evaluated and the following concerns addressed:

- A comprehensive and historical inventory of all potential chemical, physical, and biological agents in the work place must be developed and updated regularly.

- Potential exposures must be identified by determining the chemicals that an individual may come in contact with and by job tasks and work practices.

- Potential exposures must be evaluated by performance of industrial hygiene surveys.

- Exposure levels must be communicated to all personnel.

- Recommendations for lowering exposures to acceptable levels will be addressed and action plans developed for implementation.

Individual monitoring and exposure records will be maintained by the Site Safety Officer and available to all employees.

All workers will be part of a medical surveillance program.

The respiratory protection program for this Facility will be in accordance with Ciba-Geigy's Standard Operating Procedures.

The personnel protective equipment program for this site will be in accordance with Ciba-Geigy's Standard Operating Procedure.

2.9 HAZARD COMMUNICATION POLICY

2.9.1 General Company Policy

Ciba-Geigy is committed to informing its employees of hazardous substances present in their places of work in accordance with the OSHA Hazard Communication (HAZCOM) requirements, OSHA Regulations 29 CFR 1920.1200 and 1926.59. This program applies to all work operations where Ciba-Geigy employees may be exposed to hazardous substances.

Under the HAZCOM program, Facility personnel will be informed of the contents of the HAZCOM Regulations, the hazardous properties of chemicals with which they work, and safe handling procedures and measures to take to protect themselves from these chemicals.

2.9.2 Material Safety Data Sheets and Chemical Hazard Information

Material Safety Data Sheets (MSDS) provide specific information on the chemicals to which Facility personnel may be exposed. The MSDS should be a fully completed OSHA Form 174 or equivalent. Every effort will be made to obtain all pertinent MSDS or similar chemical hazard information whenever chemical exposure of personnel is possible.

The Site Safety Officer is responsible for acquiring and updating MSDS for chemicals stored in the groundwater capture, groundwater pretreatment, and soil vapor extraction systems.

2.9.3 Labels and Other Forms of Warning

Hazardous chemicals used by Facility personnel will be properly labeled. Original labels will list the chemical identity, appropriate hazard warnings, and the name and address of the manufacturer. Referral will be made to the corresponding MSDS to assist in verifying label information. Original labels will not be defaced or removed.

If chemicals are transferred from a labeled container to a portable container that is intended only for immediate use, no labels are required on the portable container. However, no hazardous materials or chemicals should be permanently used or stored in unlabeled containers.

2.9.4 Training

All personnel who work with or who are potentially exposed to hazardous chemicals will receive initial training on the Hazard Communication Standard requirements and the safe use of those chemicals. Those individuals involved in working with hazardous waste have chemical hazard training included in their basic health and safety course, in the 8-hour refresher course, and in project specific briefings.

Facility personnel not involved in the hazardous waste practice who are potentially exposed to hazardous chemicals or contaminated samples will be trained in:

- The basic requirements of HAZCOM and employees' right to information on chemical hazards.

- WCC's program to comply with HAZCOM and procedures to follow to review the standard, the company program, and MSDS record keeping/availability.

- How to interpret and use the labels on containers of hazardous materials.

- The potential physical hazards and health effects of the hazardous substances and how to use MSDS for more information.

- Methods and observations that may be used to detect the presence or release of chemicals.

- The measures that employees can take to protect themselves from chemicals.

All HAZCOM training will be documented by a sign-in sheet recording each employee's attendance, the date, and the training topics covered. This sign-in sheet will be retained by the Health and Safety Officer. Such training can be performed by any of the following individuals:

- Ciba-Geigy Project Manager;
- Site Safety Officer;
- Project Health and Safety Officer; or
- Corporate Health and Safety Manager.

The implementation of the Hazard Communication Program will be under the general direction of a Certified Industrial Hygienist.

2.9.5 Protective Measures

The use of chemical splash goggles, gloves, protective clothing, boots, and possibly respiratory protection may be required during testing of potentially contaminated samples or the handling of hazardous chemicals. If respiratory protection is used, it must be in full compliance with OSHA Regulations 29 CFR 1910.134 and 29 CFR 1926.103. All personnel protective equipment used will be in accordance with Subpart I of OSHA Regulations 29 CFR 1910 and Subpart E of OSHA Regulations 29 CFR 1926. Any emergencies involving hazardous chemicals or potentially contaminated samples must be reported to the Ciba-Geigy Project Manager and the Project Health and Safety Officer.

2.10 INCIDENT/ACCIDENT INVESTIGATION PROCEDURE

The objectives of accident investigations are to determine the immediate and underlying causes of accidents and to recommend corrective actions to prevent similar incidents/accidents from occurring.

For purposes of this procedure, an accident/incident is defined as follows:

- illness resulting from chemical exposure;
- physical injury to Facility personnel;

- fire, explosion, or flash from the Facility;
- property damage to the Facility;
- infractions of safety rules;
- unexpected chemical releases or exposures; or
- complaints from neighbors concerning any part of the facility operation.

The above list is not intended to be all inclusive but gives examples of accidents/incidents which are covered by this procedure.

The Incident Form presented in Figure 2-3 will be used as the report format for incidents and accidents.

The incident/accident will be investigated by the Site Safety Officer and Ciba-Geigy Project Manager within 24 hours of occurrence.

At the discretion of the Project Manager and the Site Safety Officer, additional resources may be utilized to accomplish a successful accident investigation.

Recommendations to prevent the accident in the future must be included in the accident investigation report.

<u>REMEMBER:</u> ACCIDENT INVESTIGATIONS GO BEYOND ASSESSING BLAME. IT IS IMPORTANT TO DETERMINE THE ROOT CAUSES OF ACCIDENT/INCIDENTS.

CIBA-GEIGY
Toms River, New Jersey

FLAME PERMIT
Use Procedure 3b

1. GENERAL

Supervision, by signing and issuing this permit, certifies that all safety factors have been considered and cared for satisfactorily.

This permit becomes VOID:
—If work is not started within one (1) hour of issuance.
—If work is stopped for longer than one (1) hour.
—At the end of the shift of the production foreman who initiated the permit.
—If an emergency alarm is sounded in the building. (Permit is revalidated if the "All Clear" is sounded within one (1) hour.
—If a fire occurs in the building where this permit is issued.
—At the stated time: ____________________ am/pm.

Date ____________ Time: Begin ____________ am/pm End ____________ am/pm

Operating Area: ____________

Specific Equipment: ____________

Work to be Done: ____________

2. SYSTEM PREPARATION

	YES	NO	N/A
Is the equipment or area satisfactorily clean of flammables?			
Is the adjoining operation or equipment considered OK from standpoint of possible effect on job?			
Have requirements of other procedures been met? (Lock Out, Confined Space Entry, etc.)			
Are proper fire extinguishers on the job?			
Is sprinkler system operable?			
Is water hose laid out and water running?			
Are tarps needed to protect adjoining areas or personnel from sparks or arc flashes?			
Is supply of fresh air needed for confined areas?			
Are lower floors, pipe chases, floor drains protected?			
Last chemical(s) in system: ____________			
Material Safety Data Sheet Available?			
Other precautions? (Protective clothing and/or equipment, signs posted.)			

Who is the fire watch? Name ____________ Department ____________

3. GAS TEST RESULTS

Production Supervision is responsible to prepare an area for gas test by flushing, purging, etc.

Is a gas test necessary? ☐ Yes ☐ No

Combustible gas test ____________ %

Other (Specify) ____________

Combustible gas test must read "0" for any Hot Work to begin.

Gas Tester's Signature ____________ Date ____________ Time ____________

4. APPROVAL

I approve this work to be done with the specified conditions.

____________ Date ____________ Time ____________
Department Head/Designee/Shift Superintendent

We have **personally** checked the conditions specified. We authorize this Hot Work to begin ____________ Date ____________ Time ____________
Production Foreman

____________ Date ____________ Time ____________
Maintenance Foreman

5. Any Extraordinary Occurrences: No / Yes, Explain: ____________

____

6. Permit Complete

Permit Complete ____________ ____________ Job Complete ____________ ____________
Date Time Date Time

____________ ____________
Production Foreman Maintenance Foreman

Form E-10

White — Production; Canary — Maintenance; Tag — Safety

CIBA-GEIGY
Toms River, New Jersey

CONFINED SPACE ENTRY PERMIT
Use Procedure 3a

1. GENERAL

This permit becomes VOID:
—If work is not started within one (1) hour of issuance.
—If work is stopped for longer than one (1) hour.
—If an emergency alarm is sounded in the building. (Permit is revalidated if the "All Clear" is sounded within one (1) hour.
—If a fire occurs in the building where this permit is issued.
—At the end of the shift of the production foreman who initiated the permit.
—At the stated time: ______________________ am/pm.

Date __________ Time: Begin __________ am/pm End __________ am/pm

Equipment No. __________ Building No. __________ Location __________

Equipment Previously Contained: ______________________ MSDS Available: Yes / No

Work to be Done: ______________________

2. SYSTEM PREPARATION

	YES	NO	N/A
Flame Permit required (Procedure 3b) (P)			
System Entry Permit required (Procedure 3c) (P)			
Lockout complete (Procedure 4a) (M)			
Equipment Empty and Washed Out (P)			
Top of equipment free of loose objects (M)			
Special Clean-up for Diazo Kettle: __________ (P) chemist's signature			
Other (Specify): __________			

3. PERSONAL PROTECTIVE EQUIPMENT AND PRECAUTIONS (Circle those required)

Safety Glasses	Rubber Suits	Safety Harness with Lifeline
Chemical Goggles	Shower After Job	Barrier Cream
Face Shield	Air-line Respirator (ALR)	Alert Whistle
Rubber Boots	AIR with Escape Bottle	Air Mover
Rubber Gloves	Self-Contained Breathing Apparatus	Hearing Protectors

4. TESTS

	Instrument No.	Date of Calibration	Test Result	Time	
Oxygen Deficiency					(M)
Flammability					(M)
Toxicity __________ chemical					(P)

Performed by: ______________________ Date __________

5. THIS CONFINED SPACE IS SAFE FOR MEN TO ENTER

______________________ Date __________ Time __________
Signature-Production Foreman

______________________ Date __________ Time __________
Signature-Dept. Head/Designee/Shift Superintendent

6. This Confined Space is Safe for Men to Enter, and the Following Men are Authorized to Enter it:

1. __________ 2. __________

SAFETY WATCHMAN IS: ______________________

____
Signature-Foreman of Above-Named Men

7. Extraordinary Occurrences: No / Yes, Explain: ______________________

8. Permit Complete __________ Date __________ Time   Job Complete __________ Date __________ Time

______________________ Production Foreman   ______________________ Maintenance Foreman

Form E-9

White — Production; Canary — Maintenance; Tag — Safety

Ciba-Geigy / Toms River REPORT OF ☐ ACCIDENT ☐ NEAR MISS

(Check One)

Employee Name	Department	Occupation	Date & Time of Accident
Date Reported to Supervisor & by Whom	Exact Location of Accident - Incident - Near Miss (Be Specific)		
Supervisor of Employee	Property Damage (Describe and Indicate Estimated $ Amount)		

Describe what happened

Other person(s) involved (name/dept.)

Explain if anything was wrong with equipment, materials, machinery

Explain if anything was wrong with layout or operating procedure

Describe any human error involved

What steps have been taken to prevent a recurrence of this accident - near miss?

Employee Signature	Date
Employee's Immediate Supervisor (Signature)	Date
Report Reviewed By	Date

Distribution and instructions shown on reverse side.
kco / Rev. 5-94

Injury Classification: ______________ / Injury No.: ______________
Safety Department Use Only

3.0
SYSTEM DESCRIPTIONS

3.1 OVERVIEW

This chapter presents system process descriptions for:

- The groundwater capture system;
- The groundwater pretreatment system; and
- The soil vâpor extraction (SVE) system.

The process descriptions for each of these systems are presented below.

3.2 PROCESS

3.2.1 Groundwater Capture System

The main design criterion for the groundwater capture system is to reverse (and maintain the reversal of) the hydraulic gradient at the bulkhead from its current direction (southeast/toward the Pawtuxet River) using the lowest practical pumping rates. In order to meet this main criterion, two secondary design criteria must be met:

- Drawdown ranging from 0.5 to 1.7 feet (depending on location) will be required on the landward side of the bulkhead; and
- Changes in the groundwater level at the bulkhead caused by infiltration of precipitation will not effect hydraulic gradient reversal.

3.2.1.1 Description

The groundwater capture system includes two to four recovery wells (PW-110, PW-120, PW-130, and PW-140), the locations of which are shown in Figure 3-1. A process and instrumentation (P&I) diagram for the groundwater capture system is presented in Volume 4. The process flow diagram for the complete stabilization system is presented in Volume 4 (Drawings No. M-1A and M-1B).

A submersible pump will be installed in each recovery well; the discharge from each well will be conveyed to a common collection pipe which conveys the combined groundwater to the groundwater pretreatment system.

3.2.1.2 Performance Standards

The following performance standards are used for measuring compliance with the design criteria:

- Drawdown on the landward side of the bulkhead will be monitored by continuous measurements of groundwater levels in wells near the bulkhead. To ensure that the required drawdown is achieved at the bulkhead, two to four recovery wells will be installed along the bulkhead; and

- Changes in groundwater levels at the bulkhead caused by the infiltration of precipitation will be monitored by continuous measurements of groundwater levels near the bulkhead, however, changes in pumping rates may not occur.

3.2.1.3 Individual Units

The groundwater recovery system, consisting of two to four recovery wells, is constructed as follows:

- Wells are constructed of 6-inch diameter stainless steel screens and casings.

- Well casings are Type 304 stainless steel. The approximate length of casing for each well is as follows:

PW-110	-	6 feet of casing to grade (15 to 9 ft mean sea level (MSL))
PW-120	-	5 feet of casing to grade (13 to 8 ft MSL) and 17 feet of casing across the Silt unit (-2 to -19 ft MSL)

- Wells screens are Type 304 stainless steel (Johnson Filtration Systems Vee-Wire Brand) with variable slot sizes selected based on the results of the sieve tests. The approximate length of screen for each well is as follows:

PW-110	-	20 feet of screen (9 to -11 ft MSL)
PW-120	-	10 feet of screen (8 to -2 ft MSL) and 15 feet of screen (-19 to -34 ft) MSL

- Wells are completed using 5 foot long silt sumps.

- Gravel pack material (as provided by Jessie Morie Co.) selected using the results of the sieve analyses extends a minimum of 1 foot above and below each screened interval.

- Well heads are installed with an above-grade pre-engineered structure to contain all controls, flow meters and water level measurement instruments.

- Each well has a dedicated Grundfos Redi-Flo Environmental submersible pump. Pump sizes are as follows:

PW-110	-	60 gpm (Model 60S50)
PW-120	-	16 gpm (Model 16E9)

- Well pump controls are integrated into the programmable logic controller (PLC) located in the well house.

- Well monitoring instruments including the individual magnetic flow meters and level probes are linked to a PLC for data logging.

3.2.2 Groundwater Pretreatment System

The main design criterion for the groundwater pretreatment system is to pretreat the extracted groundwater prior to discharge to the City of Cranston publicly-owned treatment works (POTW).

3.2.2.1 Process Description

The process flow diagram for the groundwater pretreatment system is presented in drawing M-1 of Volume 4. Drawings M-2 through M-4 present the equipment layout of the major components. The process and instrumentation diagrams (P&IDs) for the groundwater pretreatment system are presented in Volume 4 (Drawings No. I-1 through I-7).

The following unit processes are used in the pretreatment system:

- Equalization;
- Aqueous-phase activated carbon adsorption;
- Final pH adjustment, and;
- Effluent sampling.

3.2.2.2 Performance Standards

For the groundwater pretreatment system, the performance standard used for measuring compliance with the design criteria will be the negotiated effluent discharge limits established by the City of Cranston. These performance standards have been designed to provide overall protection to the environment and minimize any potential adverse impact on the POTW. The anticipated effluent concentration-based limits are presented in Table 3-1.

3.2.2.3 Individual Unit Processes

The design criteria for each unit process employed in the groundwater pretreatment system are discussed in detail below.

Equalization

Equalization is provided to minimize the fluctuations in groundwater flow and constituents to the groundwater pretreatment system. The groundwater pretreatment system is equipped with one equalization tank located within the diked area of Building No. 15 to provide secondary containment in case of a failure. The equalization tank will be constructed of stainless steel and will have a capacity of 6,000 gallons. The equalization tank will be equipped with a level control system to prevent flooding. The equalization tank will also be covered to control VOC emissions and the head-space of the tank will be vented through a disposable carbon canister.

Groundwater extracted by the SVE system (located at SWMU-11) will also be conveyed to the equalization tank. Prior to equalization, phase separation of the groundwater and free-product will occur. Any free product removed by the phase separator will be conveyed by gravity to a 1,000 gallon stainless steel free-product storage tank.

Aqueous-Phase Activated Carbon Adsorption

To provide pretreatment of the groundwater before discharge to the City of Cranston POTW, three, eight-foot diameter epoxy-coated activated carbon adsorption vessels will be installed. Two activated carbon vessels will be operated in series at any one time with the third unit being maintain in a standby mode. Each activated carbon vessel will hold about 10,000 pounds of carbon and is designed to treat up to 140 gallons per minute.

A static mixer has been added to groundwater transfer line to facilitate the addition of a sequestering agent. If deemed necessary after start-up, a sequestering agent will be added to maintain the soluble iron (in the groundwater) in solution. The sequestering agent will be stored in 55-gallon drum.

The activated carbon adsorption system is designed for backwashing to prevent plugging of the carbon media. During backwashing operations, backwash water will flow to a 10,000 gallon Backwash Storage Tank located in the diked area. Following backwashing operations, the backwash water stored in the backwash storage tank will be pumped back to the equalization tank (at a low pumping rate) for removal of any residual VOCs prior to discharge.

Final pH Adjustment System

To maintain the pH of the final effluent within the limits specified by the City of Cranston POTW, a final pH control system has been provided with the pretreatment system. The pH of the groundwater will be adjusted with either sodium hydroxide (NaOH) or sulfuric acid (H_2SO_4) as required. An 8-foot diameter, 3,000 gallon stainless steel tank will be used for final pH adjustment. This tank will be equipped with a mixer, pH controller and level control system.

An Isco automatic composite sampler is provided on the effluent line prior to discharged to the City of Cranston POTW. Samples will be collected in accordance with the POTW's Self-Monitoring Report requirements.

3.2.3 Soil Vapor Extraction System

The main design criteria for the soil vapor extraction (SVE) system is to reduce the level of organics in the soils at SWMU-11.

3.2.3.1 Description

The process and instrumentation (P&I) diagram for the SVE system is presented in Drawing I-8 of Volume 4.

Groundwater and soil gas are extracted independently of each other from the SVE wells to optimize the overall system flexibility. This capability is necessary if the groundwater extraction system must continue to operate after the SVE system has been shut-down. Soil vapor extracted during stabilization will be treated by a thermal/catalytic oxidizer before being emitted to the atmosphere. Groundwater extracted during SWMU-11 stabilization will be conveyed to the groundwater pretreatment system.

3.2.3.2 Performance Standards

The following performance standards are used for measuring compliance with the design criteria:

- Discharge of treated air (i.e., soil gas) to comply with emission limits prescribed in an air discharge permit to be negotiated with RIDEM.

- Discharge of extracted groundwater to the groundwater pretreatment system is expected to be controlled by provisions of the Industrial Discharge Permit to be negotiated with the City of Cranston POTW.

- Soil gas extraction will continue until the concentration of VOCs in the extracted soil gas remains statistically flat (i.e., becomes asymptotic as determined by data regression) for six months, based on monthly soil gas quality analytical data.

- Groundwater extraction will continue until concentrations of VOCs in the extracted groundwater in each extraction well remain statistically flat (as determined by data regression) for four quarters based on quarterly groundwater quality monitoring analytical data.

3.2.3.3 Individual Units

The SVE system extracts groundwater and soil vapor in two separate streams from a well. Groundwater is extracted through a straw in the well, while soil vapor is extracted from the unsaturated zone soils by applying vacuum directly to the well riser.

- Extraction wells;
- Vacuum pump system;
- Vapor vacuum tank system;
- Water extraction tank system;
- Water discharge pumps;
- Air purge vacuum pump;
- Thermal/catalytic oxidizer, and;
- SVE control system

Extraction Wells

The SVE system consists of seven wells in the SWMU-11 area. Wells VE-1, VE-2, VE-3, and VE-11 are designed to extract both soil vapor and groundwater. Wells VE-7, VE-9, and VE-10 are designed to extract groundwater only. Each of the seven extraction wells will be connected to the water and vapor extraction manifolds. A liquid level sensor will be used in each well to control automatically the water and vapor extraction manifold solenoid valves. The solenoid valves will control the extraction rates from the wells.

Vacuum Pump System

The vacuum pump on the SVE system is a positive-displacement rotary lobe-type vacuum blower. The system includes an inlet and exhaust silencer, and all piping which will exceed 120°F operating temperature is insulated. Instrumentation on the vacuum pump skid includes the following:

- Inlet temperature gauge
- Inlet vacuum gauge

- Exhaust temperature gauge
- Exhaust pressure gauge
- Outlet flow measuring device (annubar differential pressure gauge)

Vapor Vacuum Tank System

The vacuum pump draws pneumatic suction on a 120-gallon vapor vacuum tank, which is connected to the vapor extraction manifold and the wells. The vapor vacuum tank has a water sensor in its bottom which provides a signal to transfer the accumulated water to the water extraction manifold.

Water Extraction Tank System

Groundwater is extracted from the straw in the well by the vacuum generated in the 120 gallon water extraction tank system. The vacuum level maintained in this tank is in considerable excess of that maintained in the vapor vacuum tank, sufficient to extract fluids hydraulically. The system includes a vacuum switch to control the water discharge pumps, a high level water sensor to control the automatic operation of a small air purge vacuum pump which removes excessive air from the tank top (e.g., during start-up and in the event that an air leak occurs), and two low water level sensors to shutdown one or both of the water discharge pumps in the event that the water level in the tank gets low (e.g., air has entered the system, or during start-up). During normal operation of the system, the pumps produce and maintain the operating water vacuum, which is moderated by a small air pocket at the tank top, and the air purge vacuum pump only removes excessive air as necessary.

Water Discharge Pumps

Progressive-cavity positive displacement pumps are used to transfer collected liquid from the water extraction tank to the groundwater pretreatment system, while creating and maintaining a vacuum (22 to 25 inches Hg) in the water extraction tank. The pumps are fitted with spring loaded check valves on the discharge connections and isolation ball valves on both the suction and discharge connections, a vacuum gauge on the suction header, combination gauge on the discharge header, and are fitted with a magnetic-type flowmeter/totalizer.

Thermal/Catalytic Oxidizer

As required to meet the anticipated air emission discharge requirements, a thermal/catalytic oxidizer will be installed to reduce the effluent contamination levels to the necessary limits. This device is set up to operate using natural gas, and is capable of handling 1000 ACFM inlet air. The unit is designed for ready changeover from thermal oxidation (LEL 80 percent maximum inlet concentration) to catalytic oxidation (LEL 25-30 percent inlet concentration), as the combustible vapor concentrations decrease with time. This system is fitted with an automatic dilution air valve controlled by a temperature sensor in the exhaust stack and a shutdown temperature sensor (maximum not to exceed exhaust temp).

SVE Control System

A suitable NEMA rated control panel with circuit-breaker disconnect, control transformer, motor starters, controls and indicators provides automatic and manual control of the complete system. The short-circuit protection and disconnecting device is a three-pole circuit breaker. The motor starters are across-the-line full voltage, non-reversing, magnetic starters with three ambient compensated overloads. The control circuit has an individual 120 volt fused secondary, grounded control power transformer and external reset buttons, start/stop buttons, and pilot lights.

4.1 OVERVIEW

This sections presents information on the stabilization system's normal operation, monitoring, alternate operation, maintenance tasks, replacement and potential operating problems for the major equipment. Additional information will be added to this section once the final equipment has been selected and purchased.

4.2 EXTRACTION AND TRANSFER PUMPS

4.2.1 Normal Operation

All extraction pumps in the stabilization system are designed to run continuously. These pumps can be shut-down manually by the local H-O-A switch or by the low-level sensors. If the pumps are shut-down, they must be restarted manually.

All groundwater transfer pumps are designed to run continuously. These pumps can also be shut-down manually or automatically by their associated level sensors. If the pumps are automatically shut-down for an alarm condition, they must be restarted manually.

4.2.2 Monitoring

The operation of all pumps can be monitored at the main control panel, which has a display to indicate that each pump is operating. Visual inspection of all tanks, with respect to their level and flows, will also verify both the transfer and extraction pump operation.

4.2.3 Alternate Operation

The stabilization system was designed for both the groundwater extraction and transfer pumps to run continuously. Stand-by transfer pumps have been provided. In the event that an extraction pump fails, the transfer pump will be shut-down when the low-level sensor in the equalization tank is activated. In the event that a transfer pump fails, the stand-by transfer pump would be started to prevent the equalization tank from flooding.

4.2.4 Vulnerability

All pumping systems are vulnerable to pump failure. However, if any one pump fails, the stand-by transfer pump can be operated. If necessary, replacement pumps are readily available and require little lead-time for delivery. For this reason, any down time would be minimal. Proper upkeep and maintenance of systems must be followed to reduce the chance of system failure. A power failure would cause the entire plant to shut-down simultaneously. As a result, no major problems should occur.

4.2.5 Maintenance Tasks

The following routine maintenance tasks for the extraction and transfer pumps should be performed at the minimum frequencies indicated:

- Check the condition of piping, valves, level and pressure sensing probes quarterly.
- Submersible extraction pumps should be removed from recovery wells and inspected for worn impellers, obstructions, and corrosion annually.
- All pumps should be lubricated as required by manufacturer's literature.

4.2.6 Potential Operating Problems

Equipment and power failures are the operational problems that could impact the extraction and transfer of groundwater. Both of these problems have been covered in the section on alternate operation.

4.3 pH CONTROL SYSTEM

4.3.1 Normal Operation

The primary operational requirement for the pH control system is to maintain the pH of the groundwater within the required pH range. This is accomplished by operating the pH controllers in the automatic mode at the proper pH set-point. It also requires that one of the two chemical metering pumps are energized and enable to operate in response to the pH controller output signal.

Except during start-up, there are no specific operational tasks associated directly with operation and control of the pH control system. During start-up it is necessary for some manual operation of the pH controllers to gradually bring the groundwater pH to the desired set-point. Once the actual pH is approached, the controller can then be placed in the automatic mode.

Because of the sensitive nature of the pH instrumentation, the most important operator involvement pertains to monitoring and maintenance. With adequate monitoring and maintenance, the pH adjustment systems should provide continuous, effective control of pH.

4.3.2 Process Monitoring

Process monitoring should be performed at a minimum on a weekly basis as follows:

- Verify operation of the chemical addition system metering pumps.

- Check chemical levels in the totes and chemical inventories weekly to ensure an adequate supply of chemicals. Order new totes as necessary to satisfy pH adjustment system requirements.

- Assess past pH controller performance by reviewing the pH recorder strip chart on the main control panel.

- Obtain a sample of groundwater from the deaeration/pH adjustment tank and the final pH adjustment tank and analyze them for pH using a standard bench-top pH measuring device. Compare the result to the control system reading.

4.3.3 Alternate Operation

The pH control system includes a back-up analyzer. Each of the chemical metering systems has a back-up metering pump. If one pump should fail, the second pump can be started and place in operation.

4.3.4 Vulnerability

On-line redundancy is not necessary and therefore not provided for either of the three pH control systems. In the event of any equipment or instrument failure, the system components will go to a safe condition or shutdown until the problem is corrected by the operator. Routine monitoring should limit unscheduled emergency downtime periods.

4.3.5 Maintenance Tasks

The following routine maintenance tasks for the pH adjustment systems should be performed at the minimum frequencies indicated:

- Check the condition of piping, valves, tanks and other pertinent equipment quarterly.

- Perform general housekeeping monthly or more frequently as needed.

- Check and calibrate pH sensing instrumentation on a weekly basis.

4.3.6 Equipment Replacement

Except for the pH probes, the equipment used in the pH adjustment systems is designed for permanent installation, and given proper maintenance, their effective life should be indefinite. The pH probes consist of two glass electrodes that are somewhat delicate. They have a relatively short life, and therefore must be replaced annually, or as recommended by the manufacturer.

4.3.7 Potential Operating Problems

Potential operating problems that would impact the pH adjustment systems and preventative actions to address these problems include:

Potential Problem/Component	Preventative Actions
1. Equipment Failure	
· Chemical metering pumps	Redundant pumps provided
· Agitator	System shut-down
2. Instrument Failure	
· Controllers	None - controller fails to fixed output.
· Probes	Routine calibration and maintenance
3. Power failure	None - complete system shut-down
4. Precipitated solids handling problems (e.g. scaling)	Routine cleaning of critical components.

4.4 AQUEOUS-PHASE ACTIVATED CARBON

4.4.1 Normal Operation

Two, aqueous-phase activated carbon units will be in service at all times to provide pretreatment of the groundwater. Groundwater will be pumped to the activated carbon units following equalization. All isolation and control valves should be manually opened or closed depending on the operation being performed. All sample valves should be normally closed. Backwashing of the unit with City water has been provided to increase the "life" of the activated carbon media.

4.4.2 Process Monitoring

The pressure indicator located on the activated carbon influent line may be monitored. If pressure begins to increase, fouling of carbon piping and/carbon beds may be occurring and backwashing may be required.

4.4.3 Alternate Operation

When breakthrough occurs, the carbon unit being used must be removed from service. The stabilization system should be shut-down during the carbon transfer. The stabilization system may be operated intermittently, during carbon replacement but only if the VOC concentration in the effluent is known to be low.

4.4.4 Vulnerability

A power failure would cause the entire system to shut-down, eliminating flow to the activated carbon units. Redundancy has been provided at this location. Three identical activated carbon adsorption units have been provided. The stabilization system may be operated with only one or two units in operation at any one time.

4.4.5 Maintenance Tasks

Carbon will have to be replaced when breakthrough occurs. Backwashing of the carbon beds will also have to be performed on a regular schedule. General maintenance activities include:

- Inspect condition of piping and valves for any leaks or corrosion on a quarterly basis.
- Clean any spilled liquid resulting from sampling or replacement of carbon as soon as possible.
- Perform general housekeeping as necessary.

4.4.6 Equipment Replacement

There is no schedule associated with equipment replacement for this unit process.

4.4.7 Potential Operating Problems

The breakthrough of organic compounds into the effluent is a potential operating problem. If this occurs, the carbon bed should be removed and replaced or flow should be transferred to the next available carbon unit. Monitoring the pressure indicator on the feed line should indicate if clogging is occurring and when backwashing will be required.

4.5 SOIL VAPOR EXTRACTION (SVE) SYSTEM

4.5.1 Normal Operation

The soil vapor extraction (SVE) system will be in service as required to enhance the remove of VOCs from the unsaturated soils in the Production Area. Soil vapor from the SVE system wells will be conveyed via the vapor extraction manifold to the vapor extraction tank. Condensate and particulates collected from the soil vapor in the vapor extraction tank are removed and conveyed to the water extraction manifold. Groundwater collected from the SVE wells will be conveyed via the water extraction manifold to the water extraction tank. Groundwater collected in the this tank will be pumped to the groundwater pretreatment system. Any soil gas extracted in the water extraction tank will be conveyed back to the vapor extraction manifold. Soil gas from both the vapor extraction and water extraction tanks will be conveyed to an on-site thermal oxidizer for treatment prior to discharge to the atmosphere.

4.5.2 Process Monitoring

The pressure and vacuum gauges located at each SVE well head are to monitored on a regular basis. If the pressure or vacuum begins to increase at the SVE well heads, fouling of either the well screen or piping system may be occurring and checking/cleaning will likely be required. The operating temperature of the thermal oxidizer must also be monitored to ensure the proper level of treatment. Should the operating temperature of the thermal oxidizer increase to either over 1450 °F or drop below 140 °F, the SVE system will be shut down. The SVE system will not be allowed to be restarted until the temperature of the thermal oxidizer has reached at least 140 °F.

4.5.3 Alternate Operation

The SVE system may be removed from service at any time with no effect to either the groundwater capture or groundwater pretreatment systems. During backwashing and transfer of the activated carbon adsorption system, the SVE system may be shut-down.

4.5.4 Vulnerability

A power failure would cause the entire SVE system to shut-down, thus eliminating soil gas flow to the thermal oxidizer and groundwater flow to the groundwater pretreatment system. Redundancy is required at this location and has not been provided. The SVE system may be operated intermittently and does not have to be in operation during operation of the groundwater capture and groundwater pretreatment systems.

4.5.5 Maintenance Tasks

General maintenance activities for the SVE system includes:

- Inspect the condition of all piping, valves and gauges for proper adjustment and operation on a monthly basis.

- Change the vacuum blower and compressor oil after about 250 hours of operation. Check and adjust belts as required.

- Repaint the exterior of the thermal oxidizer as required to prevent corrosion.

- Inspect the refractory of the thermal oxidizer every other year for tearing, shrinking and/or deterioration.

4.5.6 Equipment Replacement

There is no schedule associated with equipment replacement for this unit process.

4.5.7 Potential Operating Problems

Potential operating problems that would impact the SVE system and preventative actions to address these problems include:

Potential Problem/Component	Preventative Actions
1. Vapor Extraction Tank · High Level	System shut-down, drain tank via bottom drain valve.
2. Vacuum Blower Overload	Check belt drive for proper adjustment. Check for closed valves, line restrictions and/or blockages.
3. Instrument Failures	None - controller fails to fixed output.
4. Power Failure	None - complete system shut-down

The discharge of VOCs into the atmosphere is a potential operating problem. If this occurs, the SVE system should shut-down and the thermal oxidizer should be checked for proper operation. Monitoring of the thermal oxidizer's operating temperature should indicate if the thermal oxidizer has been operating properly.

5.1 OVERVIEW

This chapter preliminary presents recommended maintenance and repair guidelines for the stabilization system. Both plant operation and maintenance tasks are the responsibility of the plant operator(s).

5.2 GENERAL

For the stabilization to operate at peak efficiency, the equipment must be maintained in good operating condition at all times. Ideally, all equipment should be available for operation at any time. This would then enable routine equipment rotation, and maintenance would be more "Preventative" rather than on a "Corrective" or "Emergency" basis. Unfortunately, there are many conditions in a groundwater pretreatment system and/or soil vapor extraction system that can render the equipment inoperable. Therefore, the goal of following maintenance activities is to ensure that the equipment availability is as high as possible.

5.3 PERSONNEL

The part-time operating personnel must be capable of recognizing the warning signs of potential equipment failures before they happen. If not noted by the PLC control system, the operating personnel should have the knowledge to determine when a piece of equipment should be deactivated to prevent damage. They must also be capable of activating the backup equipment without causing damage to the system.

Operation and general maintenance of the facility will be performed by one part-time operator, with assistance by a second operator as needed or required by OSHA. The primary responsibilities of the operator(s) will be to ensure that chemical are stocked, collection of samples, sludge dewatering, carbon backwashing, the equipment is operating properly, and the process is functioning satisfactorily. Maintenance requirements include such items as routine preventive maintenance, pump lubrication, and corrective maintenance (when potential failure is indicated). Maintenance assistance may be employed as needed for any specialized equipment, such as the instrumentation and control system, to prevent process shutdowns.

5.4 MAINTENANCE RECORD SYSTEM

The following maintenance record keeping procedures should be utilized during operation of the stabilization systems to ensure that all historical maintenance data is kept and updated.

5.4.1 General

A good starting point for any record keeping system is a listing of the manufacturer's technical literature. This includes basic technical data such as equipment model numbers, part numbers, and spare parts, and spare part ordering information. The manufacturer's information should also lists the types of maintenance required for the equipment and the specific intervals. Following the manufacturer's periodic maintenance recommendations should allow you to maintain the equipment warranty intact, and achieve peak equipment performance.

Another basic piece of maintenance data is a listing of all historic events concerning each piece of equipment in the stabilization system. This information should include at a minimum, the equipment installation date, date checked-out by the manufacturer's representative, date tested, and date started under normal operating conditions. This data should enable the maintenance staff to log operation hours and establish historical patterns of equipment performance.

The maintenance record keeping system can be very elaborate or very simple depending on the function it is intended to provide. It should be regarded as a system to aid in the maintenance of the stabilization system and not a filing system that merely collects data.

Since the manufacturer's literature is normally quite lengthy, the record system should be designed as a "quick reference" system, listing only that information most frequently required. One method of such a system is a card system. Each card should contain such information as nameplate data, manufacturer's name, address, phone number, lubrication data, etc. Figure 5-1 shows a suggested discrepancy report to record problems that need correcting, and Figures 5-2 shows one possible arrangement.

5.4.2 System Updating

Whatever system is utilized, it should be kept up-to-date at all times. The responsibility of recording the actual maintenance should be assigned to a specific individual. A "Work Order Form" may be issued when a task is assigned and returned when complete. The maintenance functions can then be logged as complete, and a listing of materials used during the maintenance can be checked against inventory to determine when reordering is necessary.

Figures 5-1 through 5-3 are examples that could be utilized to document a maintenance history on a specific piece of equipment. They can be modified in any way but should retain enough information to identify the individual piece of equipment and the work performed.

5.4.3 Equipment Numbering System

In order to properly identify each piece of equipment in the stabilization system, and to be sure that maintenance is performed on the correct unit, each piece of equipment should be individually numbered. The numbering system employed will be consistent with the existing CIBA-GEIGY equipment numbering system.

5.5 INVENTORY AND STOCK REPLENISHMENT

The following guidelines should be helpful in setting up a stockroom and creating an inventory system for the stabilization systems.

- Thoroughly review the manufacturer's literature, estimated operating hours, historical data and procurement time. Following this review, a determination must be made as to what spare parts should be stocked.
- Minimum and maximum amounts of spare parts should be calculated based upon how many units utilize that particular part.
- Multiple sources as to where the items could be purchased should be located.
- Establish a re-order point, do not wait until the stocked item is completely depleted before reordering.
- Allow special consideration should be given to stocking equipment spare parts for singular process units that cannot be inoperable for extended periods.

With some consumable items, it is extremely difficult to estimate their future needs. Items such as miscellaneous nuts, bolts, washers, electrical supplies (tape, wire nuts, wire connectors) should be stocked and re-ordered on a regular basis. Figure 5-3 presents an example of a spare-parts inventory system.

5.6 MAINTENANCE SCHEDULE

5.6.1 General

Maintenance must be planned and scheduled to provide for even work loads. The size and complexity of the system and the type of personnel available will determine the kind of maintenance schedule necessary. Routine maintenance procedures fall into patterns. Certain items will have to be checked weekly, while others may only require monthly, semi-annually, or annually. Preventative maintenance tasks as normally recommended by the manufacturer and are routine. As a result, they can be scheduled. Even major repairs and new equipment installations can be scheduled. Proper maintenance scheduling requires considerations for personnel, equipment and materials.

5.6.2 Emergency Repairs

The goal of any maintenance program is to care for equipment in such a fashion that an emergency repair does not occur due to a failure. Nevertheless, emergency situations are expected to occur during the operating of the stabilization system. Basic emergency response procedures will be established, which include: 1) an immediate action plan; 2) contact list; 3) steps for process maintenance (if emergency occurs on critical sector of system); 4) process modifications and/or system shut-down procedures.

Some system failures will have multiple effects throughout the system. As a result, an "Emergency Response Program" will be developed.

5.7 MANUFACTURER SPONSORED MAINTENANCE COURSES

Many equipment manufacturers sponsor basic maintenance seminars to educate customers who have purchased their equipment. In most cases, these educational programs are offered at either little or no cost. The programs are designed for those individuals who are charged with maintaining the equipment and usually combines "classroom" with "hands-on" troubleshooting and repair. Most of the major equipment in the stabilization system has been specified to be provided with manufacturers training for the operating personnel.

5.8 SPECIALTY ITEMS

This sections is listed separately because special attention should be provided to these topics and in some applications, action is seldom taken until accidents or near accidents occur. Although they are maintenance related, some topics are combined safety/maintenance issues.

5.8.1 Electrical vs. Mechanical Maintenance

All too often mechanical maintenance is stressed above electrical maintenance, and electrical problems are corrected as they occur. Unfortunately, electrical problems are capable of causing fires and creating far more extensive damage. Some basic electrical maintenance items include:

- Electrical motors should be checked annually for "amperage draw" with a "meggar" device. Inconsistencies should be checked and corrected.

- Motor control centers (MCCs) and circuit-breaker panels should be de-energized and cleaned annually. Dust can build up on electrical contactors and cause faulty operation.

5.8.2 Valve Exercising

The valve exercising program should include each valve in the stabilization system that is not automatically controlled or does not get used on a regular basis. At a minimum, all valves should be exercised through their full range of "opened" and "closed" on an annual basis.

All gate valves should not be turned "full open" or "full closed" without reversing the valve direction about 1/4 to 1/2 of a turn. This procedures should help prevent "freezing" of the gate within the valve body.

5.8.3 HVAC Equipment

Beyond normal maintenance of changing filters and lubricating fan motors, the heating and ventilating (HVAC) system should receive an annual inspection. Normal wear and tear on motors as well as vibration of the ducting can promote the opening of seams and result in an overall "unbalancing" of the HVAC handling system. Manufacturer's literature will normally suggest the frequency of balancing the system. Balancing of the HVAC system should help add years of operating life to the HVAC electrical equipment.

FORMER CIBA-GEIGY FACILITY
CRANSTON, RHODE ISLAND

DISCREPANCY REPORT

Operator:	Report No.
Unit:	Date:
Location:	
Description of Problem:	
Action Taken:	
Maintenance Performed:	
Signature:	
Date Completed:	

FORMER CIBA-GEIGY FACILITY
CRANSTON, RHODE ISLAND

MAINTENANCE RECORD CARD

Equipment Description & No.	
Model No.	**Spare Parts**
Serial No.	
Location:	Number and Description
Manufacturer:	
Equipment Data:	

FORMER CIBA-GEIGY FACILITY
CRANSTON, RHODE ISLAND

SPARE PARTS INVENTORY

Part		Received		Used		Number In Stock
Number	Description	Date	Number	Date	Number	

Additional Information:

Figure 5-3

6.1 OVERVIEW

This section includes information on chemical control procedures, sampling procedures, and on-site and off-site testing procedures.

6.2 CHEMICAL CONTROL

This section covers control of chemical dosage by describing the methods of controlling the various chemical additional systems, by summarizing chemical data needed in calculations, and by showing how to perform the required chemical dosage calculations. It is recommended that the manufacturer's data be consulted for more detailed information about the operation of specific equipment. Chemical suppliers also can provide information on the chemicals used in the stabilization system and are required by law to provide a copy of the "material safety data sheet" (MSDS) for each of the products that they provide.

6.2.1 Chemical Feed Systems

Two to three different chemicals used in the stabilization system including sodium hydroxide, sulfuric acid, and sequestering agent. These chemicals are all injected into the pretreatment system in the form of a liquid solution. All of the above chemical are to be purchased in 300 gallon totes with the exception of the polymer which will be supplied in 55 gallons drums.

Control of chemical dosage depends on the control of the chemical feed systems and especially the chemical feed pumps. The feed systems for addition of sodium hydroxide, hydrogen peroxide and sulfuric acid are all identical in function. The polymer addition system is different from these and is a pre-engineered package system.

The chemical metering pumps all have one controllable feature, the stroke length setting as a fraction of full stroke. One full stroke length of the pump will deliver a fixed volume of chemical to the pretreatment system. A fractional stroke length will also deliver a fixed volume of chemical, but proportionately less than the full stroke. The stroke setting is shown on a micrometer at each pump and can be increased or decreased depending on the flowrate of chemical addition required.

6.2.2 Chemical Dose Calculations

One method of determining the correct chemical dose is to perform a jar test. Jar tests are performed using several different chemical doses. The chemical dose that gives the best results, will then be used to calculate the amount of chemical to be added to the pretreatment system to obtain the same results. The procedure for running jar tests is described later in this chapter.

The correct chemical dose can be determined by using the following method:

STEP 1 *CALCULATE THE AMOUNT OF CHEMICAL NEEDED PER DAY.*

Amount of Chemical Needed Per Day (lbs) = Dose (mg/L or ppm) x Flow (MGD) x 8.34

STEP 2 *CALCULATE THE GALLONS PER HOUR THAT THE CHEMICAL FEED PUMP MUST SUPPLY.*

As part of this step, the strength of the chemical to be added must be known. The chemical flow in gallons per day is calculated from the amount of chemical needed (lb/day) divided by the solution strength (lb/gal) of the chemical to be added to the pretreatment system. This result is then divided by 24 to covert the flow from gal/day to gal/hr. The entire calculation is as follows:

Gallons per hour (gal/hr) = lb/day/strength in lb/gal/ 24 hr/day

STEP 3 *ADJUST THE PUMP STROKE SETTING TO OBTAIN THE CORRECT CHEMICAL FEED RATE.*

The pump adjustment is based on pre-determined calibration curves or on measurement of chemical flow rate after the stroke is adjusted.

6.2.3 Calibration Curves

Calibration curves for the chemical metering pumps can be prepared to show the correlation between pump stroke and chemical flow rates (gal/hr) for various plant flow rates. The calibration curves should be checked quarterly, because pump wear can reduce chemical flow and change the pump output.

6.2.4 Chemical Flow Measurement

As an alternative method to using calibration curves, the chemical flow can be measured directly using the calibration kit. This measurement should be made after each stroke length adjustment. The stroke length should be changed until the desired chemical flow rate is obtained at a constant pump speed. It is good practice to check the chemical flow rate when making stroke length adjustments based on calibration curves.

As an alternative to using the calibration kit, a sample of chemical may be collected from the pump discharge over a timed period to determine the flow per minute or hour. Care should be taken when collecting samples or checking calibration to avoid possible exposure to chemicals. Protective clothing, safety glasses, and gloves should be worn at all times.

6.2.5 Jar Testing

Jar testing is performed to determine the optimum chemical dose required. All jar tests results should be confirmed by field verification.

Equipment for Jar Test
The equipment requirements associated with jar testing are dependent upon the treatment objectives and the water quality parameters of concern. The principal equipment required to conduct the jar test includes:

- One, Six Station Gang Mixer.
- Eight, 1-liter Beakers.
- One, 5-Liter Beaker or Bottle.
- One, Illuminated Base (preferred, but not required).
- Stock Chemical Solutions
- One, Magnetic Stirrer Base
- Magnetic Stirring Bars (1 dozen)
- Two, 1-Liter Volumetric Flasks.

Preparation of Chemicals
Solutions of sodium hydroxide (NaOH) and sulfuric acid (H_2SO_4) must be prepared in concentrations suitable for use in jar testing. The small quantities of water that are utilized during jar testing necessitate that the chemical stock solutions be diluted.

For jar testing requiring NaOH, a 0.1 Normal (N) solution of sodium hydroxide is generally sufficient for pH adjustment. Reagent grade sodium hydroxide is usually supplied in pellet form and must be diluted. To prepare a 0.1 N solution the following procedure should be followed:

(1) Add 200 to 500 ml of distilled water to a clean volumetric flask.

(2) Drop in a magnetic stirring bar and place the flask onto a magnetic stirrer.

(3) Weigh out 4 grams of sodium hydroxide pellets onto an aluminum or plastic

weighing dish.

(4) Pour all of the pellets into the volumetric flask. Mix at medium speed until all of the pellets dissolve.

(5) Remove the magnetic stirring bar and fill the volumetric flask to the mark with distilled water.

(6) Cap and shake for at least one minute.

(7) The strength of the stock solution will be 4000 mg/l or 4 mg/ml as 100% NaOH. Therefore, 1 ml added to a 2 liter jar will be equivalent to a dose of 2 mg/l.

For jar testing requiring sulfuric acid, a 0.1 N solution of sulfuric acid is generally sufficient for pH adjustment. Reagent grade sulfuric acid is usually supplied in liquid form. This preparation requires dilution of 99% sulfuric acid. To prepare a 0.1 N solution of sulfuric acid the following procedure should be followed:

(1) Add 200 to 500 ml of distilled water to a clean volumetric flask.

(2) Drop in a magnetic stirring bar and place the flask onto a magnetic stirrer.

(3) Pipette out 2.7 ml of 99% sulfuric acid.

(4) Place the measured amount of sulfuric acid into the volumetric flask. Mix at medium speed for about 1 minute.

(5) Remove the magnetic stirring bar and fill the volumetric flask to the mark with distilled water.

(6) Cap and shake for at least one minute.

(7) The strength of the stock solution will be 4900 mg/l or 4.9 mg/ml as H_2SO_4. Therefore, 1 ml added to a 2 liter jar will be equivalent to a dose of 2.45 mg/l.

<u>pH Adjustment Using NaOH or H_2SO_4 Procedure</u>

(1) Remove jars from gang stirrer and pour off supernatant in each jar into additional 1-liter jars (remember to label the additional jars accordingly).

(2) Place a magnetic stirring bar into each jar and place one of the jars on the jars on the magnetic stirrer. Run the stirrer on medium speed.

(3) While continuously monitoring the pH, Slowly add 0.1 N NaOH or H_2SO_4 with a pipet until a pH of 7.0 is reached. Record the amount of NaOH or H_2SO_4 needed.

(4) Continue the same pH adjustment for the remaining jars at different pH values (6.5, 7.5, 8.0).

NaOH Feed Rate Calculation
Using the NaOH stock solution concentration and the current flow rate of the treatment system, the feed rate can be calculated using the following formula:

Feed Rate of NaOH (gph) = Volume of Stock NaOH Needed in Jar Test (ml) x Concentration of Stock NaOH (mg/ml) x Pretreatment System Flow Rate (gpm) x 2.46 x 10-5

H_2SO_4 Feed Rate Calculation
Using the H2SO4 stock solution concentration and the current flow rate of the treatment system, the feed rate can be calculated using the following formula:

Feed Rate of H_2SO_4 (gph) = Volume Stock H_2SO_4 Needed in Jar Test (ml) x Concentration of Stock H_2SO_4 (mg/ml) x Pretreatment System Flow Rate (gpm) x 3.52 x 10-5

6.3 LABORATORY ANALYSIS

Both on-site and off-site laboratory analysis of samples at selected locations within the stabilization system will provide the engineering data necessary for evaluation of the treatment process. Additional information on the specific laboratory analysis to be performed will be provide once the requirements of the groundwater pretreatment system's discharge permit have been obtained. All required analysis for submission to the City of Cranston will be performed a laboratory certified by the State of Rhode Island.

6.4 SAMPLING

"Representative" samples is key in obtaining good laboratory testing results. "Representativeness" of sample means the sample obtain from the stabilization system truly reflects the quality and characteristics of the stream that is sampled. Good sampling requires proper sampling techniques, proper handling of samples, and proper storage techniques. Both grab and composite samples are anticipated for the stabilization system. Both types of sampling is discussed below.

6.4.1 Grab Samples

Grab samples are collected instantaneously from one location. A grab sample represents the condition that exists only at the time the sample was collected. Grab samples are taken for any of the following reasons:

- When samples must be analyzed immediately for constituents such as: pH, and temperature, and;

- When analytical results are required immediately and time is not available to collect a composite sample.

6.4.2 Composite Samples

A composite sample consists of a combination of grab samples that are taken over a period of time. Composite samples represent average water quality conditions over the sampling period. Most analyses required to be submitted to RIDEM and the City of Cranston (with the exception of VOCs which must be obtained by grab samples) must be based on composite samples. For the stabilization system, all composite samples will be performed over a 24-hour period in intervals of 1-hour or less. The samples will be collected using a refrigerated Isco sampler. Samples for VOCs will require that grab samples be obtained. VOC samples will be obtained during average operating conditions.

6.4.3 Sampling Technique

Grab samples should be obtained at a location where either the groundwater or sludge stream to be sampled is well mixed. All composite samples will be obtained automatically by the Isco samplers. Exclude all floating material, "scrapings" from the sides of tanks, and any material larger than one-quarter inch in size.

6.4.4 Sample Handling

Samples should be collected and stored in clean containers. Samples taken for the purpose of measuring pH and temperature must be analyzed immediately and if possible, at the location where they are taken. All other samples should be refrigerated at 4°C until they are analyzed. Precise procedures for sample storage methods and holding times are contained in the 17th edition of Standard Methods for the Examination of Water and Wastewater.

PART 1 GENERAL

1.01 SUMMARY

A. This Section describes the Instrumentation Control and Monitoring Systems (ICMS) for the Final Stabilization Action at the Ciba-Geigy Facility, Cranston, Rhode Island. The intent of this Section is to supplement, where applicable, other Sections of Division 13, and amplify information contained in other sections.

1.02 FUNCTIONS

A. The primary function of the ICMS shall be to provide centralized control and monitoring of each unit process for the treatment of extracted ground water. Each ICMS will communicate to the Building 15 Control Room to provide visual and audible information on operating parameters, equipment status, and alarm conditions.

B. Major constituents of the ICMS include an Analog Subsystem (AS), a Programmable Controller Subsystem (PCS), and Supervisory Computer and Data Acquisition system (SCADA).

1.03 CONTROL PHILOSOPHY

A. For control purposes, the ICMS shall be divided into the following four (4) Unit Processes:

1. Pumping Wells for Ground Water Extraction
2. Equalization
3. Granulated Activated Carbon Treatment (GAC)
4. Final pH adjustment and Discharge

B. The ICMS shall be designed to run automatically with minimal operator interface. However, the capability shall be provided for limited local manual control of system operations. Critical functions and changes to the system configuration shall be permitted only after verification of security passwords.

1.04 FUNCTIONAL REQUIREMENTS

A. General:

1. The ICMS shall provide all of the functions described herein for each Unit Process. Major equipment items are specified for each Unit Process, however all items of equipment necessary to implement the required Unit Process performance shall be provided.

B. Format:

1. Functional requirements are grouped by Unit Process.
2. Each Unit Process is divided into four subheadings: Overview, Analog/Digital Subsystem Functions, Programmable Controller

Subsystem Functions, Supervisory Control and Data Acquisition System Functions.

3. The Analog/Digital Subsystem Functions subheading is further divided into two sections: Sensors/Transmitters and Control.
4. The Programmable Controller Subsystem Functions subheading is further divided into four sections: Control, Data Acquisition, Interlocks, and Alarms

C. Components:

1. Analog Subsystem:

   a. Overview - Process Sensor/Transmitter Instruments: Process sensor/transmitter instruments shall measure pressure, pH, level and flow for Unit Processes 1 to 4 as specified herein. The instruments shall have the capability of communicating using the Highway Addressable Remote Transmitter (HART) protocol for the purpose of transmitting process information and instrument status as well as providing a means for remote calibration. If HART compatible devices are not available, the specified instrument shall transmit a 4-20mA dc signal in linear proportion to the measured variable. The devices shall conform to the individual instrument specifications described in subsequent sections of Division 13.

2. Programmable Controller Subsystem:

   a. Overview - Programmable Logic Controller (PLC): The Programmable Logic Controller shall provide all functions for Unit Processes 1 to 4 as specified herein and as shown on the Drawings including:

      (1) Execution of the appropriate PID loop control algorithm;
      (2) Data acquisition from process sensors and conversion to engineering units;
      (3) Totalization of elapsed run time for all equipment items that have an ON/OFF status;
      (4) Alternation of the lead pumps in the appropriate tanks at a preselected interval;
      (5) Primary alarm detection and logging; and
      (6) Interfacing with and supporting the Supervisory Control and Data Acquisition System.

   b. Overview - Operator Interface (OI)
      The Operator Interface shall provide local

3. Supervisory Control and Data Acquisition System:

   a. Overview: The Supervisory Control and Data Acquisition System (SCADA) shall consist of a Digital Equipment Corporation minicomputer running the Wonderware InTouch process monitoring and control software package under the Microsoft Disk Operating System (MS-DOS) and Windows Graphical User

Interface program. The computer shall communicate to the PLC over a Modbus Plus link using a communications adapter board and software supplied by the PLC manufacturer. The InTouch software package shall provide a driver to read and write data to the PLC over the Modbus Plus link. The software package shall also act as the primary method of operator interface with the PLC through the means of keyboard, function keys and graphic displays (Man-Machine Interface (MMI)). The MMI shall perform the following specific tasks:

(1) Display at operator's request operational status of Unit Processes, Unit Process data, alarm indication, and alarm logging;
(2) Provide operator access, using a minimum of keystrokes, to modify parameter values, change the status of ON/OFF equipment when required, and to acknowledge alarms;
(3) Provide password protection to prevent entering of unauthorized changes;
(4) Display real-time trends of all analog/digital process data over an eight hour interval;

The SCADA functions shall perform the following specific tasks:

(1) Update the internal process database continually by scanning PLC input and output registers;
(2) Display information from the process database automatically on user created color graphic displays;
(3) Produce alarm messages based on specific conditions that occur in the process data base;
(4) Produce historical trend graphs on user selected data samples from the process data base; and
(5) Generate a user customized report, either on demand or automatically, and direct the report to the video screen, the system printer, to a disk storage file, or other suitable output device.

D. Unit Process 1 - Pumping Wells for Ground Water Extraction (P&ID I1)

1. Overview

a. The Pumping Wells for Ground Water Extraction shall deliver extracted ground water into Equalization Tank T-300 via a 4" forced main header at an expected combined average flow rate of 60 gallons per minute (gpm) to a maximum of 90 gpm. Flow control from the individual Pumping Wells (PW) shall be accomplished by varying the speed of the pump using a variable frequency drive (VFD) controller to maintain a differential setpoint level between the Monitoring Wells (MW) and Stream Wells (SW).

b. The Pumping Wells for Ground Water Extraction Unit Process shall consist of three pumping wells (PW-110, PW-120 and PW-130), three monitoring wells (MW-110, MW-120 and MW-130), three stream wells (SW-110, SW-120 and SW-130), three submersible well pumps (P-110, P-120 and P-130), nine continuous level transmitters (LT-110A, LT-110B, LT-110C, LT-120A, LT-120B, LT-120C, LT-130A, LT-130B and LT-130C) three level switches (LS-110, LS-120 and LS-130), three flow transmitters (FT-110, FT-120 and FT-130), three pressure transmitters (PT-110, PT-120 and PT-130), and three pressure indicators (PI-110, PI-120 and PI-130).

c. Water from Pumping Well PW-110 shall be delivered at a rate sufficient to maintain a differential setpoint level between Stream Well SW-110 and Monitoring Well MW-110 of 1.7 feet as monitored by continuous level probes LT-110C and LT-110B, respectively.

d. Water from Pumping Well PW-120 shall be delivered at a rate sufficient to maintain a differential setpoint level between Stream Well SW-120 and Monitoring Well MW-120 of 0.5 feet as monitored by continuous level probes LT-120C and LT-120B, respectively.

e. Water from Pumping Well PW-130 shall be delivered at a rate sufficient to maintain a differential setpoint level between Stream Well SW-130 and Monitoring Well MW-130 of 0.5 feet as monitored by continuous level probes LT-130C and LT-130B, respectively.

2. Analog/Digital Subsystems Functions:

a. Sensors/Transmitters:
Measure the following parameters and transmit a digital signal to the local PCS (where XXX refers to the equipment/instrument at the appropriate well location):

(1) Level of Pumping Well (LT-XXXA).
(2) Level of Monitoring Well (LT-XXXB).
(3) Level of Stream Well (LT-XXXC).
(4) Flow rate of extracted groundwater from Pumping Well (FT-XXX)
(5) Pumping Well discharge pressure (PT-XXX)
(6) Input status of Pumping Well Level Transmitter (LT-XXXA).
(7) Input status of Monitoring Well Level Transmitter (LT-XXXB).
(8) Input status of Stream Well Level Transmitter (LT-XXXC).
(9) Input status of Flow Transmitter (FT-XXX).
(10) Input status of Pressure Transmitter (PT-XXX).

b. Control:

(1) Input HAND and AUTO selection for each pump motor (HS-XXXB).
(2) Input ON selection for each pump motor (HS-XXXC).
(3) Input OFF selection for each pump motor (HS-XXXD).
(4) Input FIELD DISCONNECT status for each pump motor (HS-XXXA).
(5) Input status of shelter security switch (YS-XXX).

3. Programmable Controller Subsystem Functions:

a. Control:

(1) If AUTO selected, provide ON-OFF function to Pump motor P-XXX.
(2) Provide feedback control of Well Pump P-XXX flow by transmitting a digital signal to VFD-XXX based on differential level of LT-XXXC and LT-XXXB. Feedback control loop shall have two modes: MANUAL and AUTO. In AUTO, pump motor speed shall be adjusted until the differential level, as determined by measuring Stream Well level at LT-XXXC and Monitoring Well level at LT-XXXB, equals the setpoint. In MANUAL, pump motor speed shall be adjusted by manually varying the loop output digital signal.
(3) Totalize runtime in minutes for pump P-XXX
(4) Provide means to reset each runtime totalizer if reset function selected.
(5) Provide failure indication output if pump P-XXX stops running when it is supposed to be in run state.
(6) Provide indication output if LT-XXXA status changes.
(7) Provide indication output if LT-XXXB status changes.
(8) Provide indication output if LT-XXXC status changes.
(9) Provide indication output if FT-XXX status changes.
(10) Provide indication output if PT-XXX status changes.

b. Data Acquisition:
Monitor the following parameters:

(1) HAND and AUTO selection indication for Pump P-XXX (HS-XXXB)
(2) Variable Frequency Drive status for Pump P-XXX (VFD-XXX).
(3) Local FIELD DISCONNECT status for Pump P-XXX (HS-XXXA).
(4) ON selection indication for Pump P-XXX (HS-XXXC).
(5) OFF selection indication for Pump P-XXX (HS-XXXD).
(6) Shelter security switch status for Pumping Well Enclosure XXX (YS-XXX).
(7) Status of LT-XXXA.
(8) Status of LT-XXXB.
(9) Status of LT-XXXC.
(10) Status of FT-XXX.
(11) Status of PT-XXX.

Scale to engineering units and store in memory:

(12) Pumping Well Level, LT-XXXA.
(13) Monitoring Well Level, LT-XXXB.
(14) Stream Well Level, LT-XXXC.
(15) Pumping Well Flow Rate, FT-XXX
(16) Pumping Well Discharge Pressure, PT-XXX

c. Interlocks:

(1) Stop Pumping Well pumps (P-110, P-120 or P-130) if: Equalization Tank Level (LT-300) high high.

d. Alarms:

(1) Pumping Well Level (LT-XXXA) high high.
(2) Pumping Well Level (LT-XXXA) high.
(3) Pumping Well Level (LT-XXXA) low.
(4) Pumping Well Level (LT-XXXA) low low.
(5) Monitoring Well Level (LT-XXXB) high high.
(6) Monitoring Well Level (LT-XXXB) high
(7) Monitoring Well Level (LT-XXXB) low.
(8) Monitoring Well Level (LT-XXXB) low low.
(9) Stream Well Level (LT-XXXC) high high.
(10) Stream Well Level (LT-XXXC) high.
(11) Stream Well Level (LT-XXXC) low.
(12) Stream Well Level (LT-XXXC) low low.
(13) Differential Level high high.
(14) Differential Level high.
(15) Differential Level low.
(16) Differential Level low low.
(17) Pumping Well Flow (FT-XXX) high high.
(18) Pumping Well Flow (FT-XXX) high.
(19) Pumping Well Flow (FT-XXX) low.
(20) Pumping Well Flow (FT-XXX) low low.
(21) Pumping Well Discharge Pressure (PT-XXX) high high.
(22) Pumping Well Discharge Pressure (PT-XXX) high.
(23) Pumping Well Discharge Pressure (PT-XXX) low.
(24) Pumping Well Discharge Pressure (PT-XXX) low low.
(25) Pumping Well Level Transmitter (LT-XXXA) status change .
(26) Monitoring Well Level Transmitter (LT-XXXB) status change.
(27) Stream Well Level Transmitter (LT-XXXC) status change .
(28) Pumping Well Discharge Pressure Transmitter (PT-XXX) status change.
(29) Pumping Well Flow Transmitter (FT-XXX) status change.
(30) Pump P-XXX motor starter tripped.

4. Supervisory Control and Data Acquisition System Functions: The Man-Machine Interface (MMI) function of the SCADA system shall display the following information:

(1) Process control loop parameters and mode.
(2) Mode and status of pump P-XXX
(3) Analog values of parameters listed in paragraph 3b items 12 to 16.
(4) Display cumulative run times of Pump P-XXX.
(5) Display alarm indications as listed in paragraph 3d. Provide means for alarm acknowledgement.
(6) Provide operator interface to:
Activate ON-OFF function to pump P-XXX;
Change differential flow control loop parameters and mode;
Reset run time totalizer of pump.
(7) Provide real time trends of analog parameters listed in paragraph 3b items 12 to 16.
(8) Provide real time trend of differential level control loop output.

All Unit Process parameters listed in paragraph 3b and alarms listed in paragraph 3d shall be made available over the communication link to the host computer and the WONDERWARE graphical process interface software.

E. Unit Process 2 - Equalization
(P&ID I2)

1. Overview

a. The Equalization Unit Process consists of one tank to receive the extracted ground water from Unit Process 1 and the ground water obtained from the Soil Vapor Extraction (SVE) Unit Process (See ABCDEFG for description of SVE system) after phase separation. The flow of ground water from the Equalization Unit Process tanks is delivered at a rate sufficient to maintain at a setpoint level in the tank.

b. The Equalization Unit Process shall consist of the extracted ground water tank (T-200), one mixers (A-200), two pumps (P-210 and P-211), one level transmitters (LT-200), one level switches (LS-200), three pressure indicators (PI-210A, PI-210B and PI-211), one pressure transmitters (PIT-210), one flow indicating transmitters (FIT-200), and twelve hand switches (HS-200A, HS-200B, HS-200C, HS-200D, HS-210A, HS-210B, HS-210C, HS-210D, HS-211A, HS-211B, HS-211C, HS-211D

c. The level of tank T-200 shall be maintained at setpoint conditions by monitoring the level continuously at LT-300 and adjusting the flow rate accordingly to a maximum of 90 gpm.

2. Analog Subsystems Functions:

a. Sensors/Transmitters:
Measure the following parameters and transmit a digital signal to the local PCS:

(1) Level of Tank T-200 (LT-200).
(2) Speed of either pump motor P-210 or P-211 (SIC-210 or SIC-211)
(3) Discharge Pressure of either Pump P-210 or P-211 (PT-210).
(4) Effluent flow rate of Tank T-200 (FIT-200).
(5) Input status of T-200 level transmitter (LT-200).
(6) Input status of pump P-210 or P-211 discharge pressure transmitter (PT-210).
(7) Input status of T-200 flow indicating transmitter (FIT-200).

b. Control:

(1) Input HAND and AUTO selection for agitator motor A-200 (HS-200B).
(2) Input ON selection for agitator motor A-200 (HS-200C).
(3) Input OFF selection for agitator motor A-200 (HS-200D).
(4) Input FIELD DISCONNECT status for agitator motor A-200 (HS-200A).
(5) Input status of agitator motor A-200 starter auxiliary (YY-200) at Motor Control Center (MCC) PCS.
(6) Input HAND and AUTO selection for pump motor P-210 (HS-210B).
(7) Input ON selection for pump motor P-210 (HS-210C).
(8) Input OFF selection for pump motor P-210 (HS-210D).
(9) Input FIELD DISCONNECT status for pump motor P-210 (HS-210A).
(10) Input status of pump motor P-210 variable frequency drive (SIC-210)
(11) Input HAND and AUTO selection for pump motor P-211 (HS-211B).
(12) Input ON selection for pump motor P-211 (HS-211C).
(13) Input OFF selection for pump motor P-211 (HS-211D).
(14) Input FIELD DISCONNECT status for pump motor P-211 (HS-211A).
(15) Input status of pump motor P-211 variable frequency drive (SIC-211)

3. Programmable Controller Subsystem Functions:

a. Control:

(1) If AUTO selected, provide ON-OFF function to agitator motor A-200.
(2) Totalize runtime in minutes for agitator A-200.
(3) Provide means to reset each runtime totalizer if reset function selected.
(4) Provide failure indication output if agitator A-200 stops running when it is supposed to be in run state.
(5) If AUTO selected, provide ON-OFF function to pump motor P-210.
(6) Totalize runtime in minutes for pump P-210.

(7) Provide means to reset each runtime totalizer if reset function selected.
(8) Provide failure indication output if pump P-210 stops running when it is supposed to be in run state.
(9) If AUTO selected, provide ON-OFF function to pump motor P-211.
(10) Totalize runtime in minutes for pump P-211.
(11) Provide means to reset each runtime totalizer if reset function selected.
(12) Provide failure indication output if pump P-211 stops running when it is supposed to be in run state.
(13) Provide feedback control of Equalization Tank T-200 level by transmitting a digital signal to SIC-200. Feedback control loop shall have two modes: MANUAL and AUTO. In AUTO, level shall be maintained modulating SIC-200 until the level measured at LT-200 equals the setpoint. In MANUAL, SIC-200 may be manually modulated by varying the output digital signal until the desired level is achieved.

b. Data Acquisition:
Monitor the following parameters:

(1) HAND and AUTO selection indication for agitator A-200 pumps P-210 and P-211 (HS-XXXB).
(2) ON selection for agitator A-200 pumps P-210 and P-211 (HS-XXXC).
(3) OFF selection for agitator A-200 pumps P-210 and P-211 (HS-XXXD).
(4) FIELD DISCONNECT status for agitator A-200 pumps P-210 and P-211 (HS-XXXA).
(5) Motor starter status for agitator A-200 (YY-200) at MCC PCS.
(6) Status of LT-200.
(7) Status of PIT-210.
(8) Status of FIT-200.

Scale to engineering units and store in memory:

(9) Equalization tank T-200 Level, LT-200.
(10) Pump P-210 or P-211 Discharge Pressure , PIT-210.
(11) Equalization tank T-200 Flow Rate, FIT-200.

c. Interlocks:

(1) Stop Equalization Tank T-200 discharge pump (P-210 or P-211) if: Tank Level (LT-200) low.
(2) Stop Equalization Tank T-200 discharge pump (P-210 or P-211) if: Final pH Adjustment Tank (T-500) Level (LT-500) high high.
(3) Stop Equalization Tank T-200 discharge pump (P-210 or P-211) if: flow rate (FIT-200) greater than 90 gpm.

d. Alarms:

(1) Equalization Tank T-200 Level (LT-200) high high.
(2) Equalization Tank T-200 Level (LT-200) high.
(3) Equalization Tank T-200 Level (LT-200) low.
(4) Equalization Tank T-200 Level (LT-200) low low.
(5) Equalization Tank T-200 Pump P-210 or P-211 Discharge Pressure (PIT-210) high high.
(6) Equalization Tank T-200 Pump P-210 or P-211 Discharge Pressure (PIT-210) high.
(7) Equalization Tank T-200 Pump P-210 or P-211 Discharge Pressure (PIT-210) low.
(8) Equalization Tank T-200 Pump P-210 or P-211 Discharge Pressure (PIT-210) low low.
(9) Equalization Tank T-200 Flow (FIT-200) high high.
(10) Equalization Tank T-200 Flow (FIT-200) high.
(11) Equalization Tank T-200 Flow (FIT-200) low.
(12) Equalization Tank T-200 Flow (FIT-200) low low.
(13) Equalization Tank T-200 Level Transmitter (LT-200) status change .
(14) Equalization Tank T-200 Flow Indicating Transmitter (FIT-200) status change.
(15) Agitator A-200 motor starter (YY-200) tripped.

4. Supervisory Control and Data Acquisition System Functions:
The Man-Machine Interface (MMI) function of the SCADA system shall display the following information:

(1) Process control loop parameters and mode.
(2) Mode and status of agitator A-200 pumps P-210 and P-211
(3) Digital values of parameters listed in paragraph 3b items 9 to 11.
(4) Display cumulative run times of Equalization Tank agitator A-200 pumps P-210 and P-211.
(5) Display alarm indications as listed in paragraph 3d. Provide means for alarm acknowledgement.
(6) Provide operator interface to:
Activate ON-OFF function to agitator A-200 pumps P-210 and P-211;
Change Equalization Tank T-200 level control loop parameters and mode;
Reset run time totalizer of each agitator and pump;
Change alarm setpoint value for digital parameters listed in paragraph 3b items 9 to 11;
(7) Provide real time trends of digital parameters listed in paragraph 3b items 9 to 11.
(8) Provide real time trend of level control loop output for Equalization Tank T-200.

All Unit Process parameters listed in paragraph 3b and alarms listed in paragraph 3d shall be made available over the communication link to the host computer and the Wonderware graphical process interface software.

F. Unit Process 3 - Granulated Activated Carbon (GAC) System (P&IDs E-51303 and E-51307)

1. Overview

a. The GAC system consists of three units with carbon capacity of 20,000 pounds each. The GAC units are 10 feet in diameter by 18 feet total height and are capable of operating at pressures of 125 psig. Groundwater is pumped to the GAC system through a 4" carbon steel pipe. Flows to the individual GAC units will be based on the number of units in operation and shall be maintained by a pneumatically actuated flow valve. Flow to the GAC unit may be diverted directly to the Final pH Adjustment Tank by means of a flow valve. The effluent from the GAC system flows through a 4" carbon steel pipe to the Final pH Adjustment Tank.

b. The GAC System Unit Process shall consist of three Modified Model 10 Granulated Activated Carbon Units (F-401, F-402 and F-403), twenty flow valves (FV-400A, FV-400B, FV-401A, FV-401B, FV-401C, FV-401D, FV-401E, FV-401F, FV-402A, FV-402B, FV-402C, FV-402D, FV-402E, FV-402F, FV-403A, FV-403B, FV-403C, FV-403D, FV-403E and FV-403F), forty valve position indicators (ZSH-400A, ZSL-400A, ZSH-400B, ZSL-400B, ZSH-401A, ZSL-401A, ZSH-401B, ZSL-401B, ZSH-401C, ZSL-401C, ZSH-401D, ZSL-401D, ZSH-401E, ZSL-401E, ZSH-401F, ZSL-401F, ZSH-402A, ZSL-402A, ZSH-402B, ZSL-402B, ZSH-402C, ZSL-402C, ZSH-402D, ZSL-402D, ZSH-402E, ZSL-402E, ZSH-402F, ZSL-402F, ZSH-403A, ZSL-403A, ZSH-403B, ZSL-403B, ZSH-403C, ZSL-403C, ZSH-403D, ZSL-403D, ZSH-403E, ZSL-403E, ZSH-403F and ZSL-403F), three pressure differential switches (PDS-401, PDS-402, and PDS-403) and six pressure indicating transmitters (PIT-401A, PIT-401B, PIT-402A, PIT-402B, PIT-403A, and PIT-403B).

c. Groundwater flow through GAC unit F-XXX (where XXX identifies the individual GAC unit) shall be achieved by opening flow valves FV-XXXA and FV-XXXB.

d. At scheduled intervals, or when PDS-XXXX is activated, the GAC units shall be backwashed at a flow of 560 gpm. Backwash shall be automatically controlled after initiation by operating personnel. The backwash cycle shall close FV-XXXA and FV-XXXB and opening FV-XXXC and FV-XXXD of the GAC unit to be backwashed.

2. Analog Subsystems Functions:

a. Sensors/Transmitters:
Measure the following parameters and transmit a digital signal to the local PCS:

(1) Inlet pressure of GAC F-401 (PIT-401A).
(2) Outlet pressure of GAC F-401 (PIT-401B)
(3) Inlet pressure of GAC F-402 (PIT-402A).
(4) Outlet pressure of GAC F-402 (PIT-402B)
(5) Inlet pressure of GAC F-403 (PIT-403A).
(6) Outlet pressure of GAC F-403 (PIT-403B)

b. Control:

(1) Position of GAC system influent flow valve (FV-400A).
(2) Position of GAC system by-pass flow valve (FV-400B).
(3) Input status of GAC F-401 inlet pressure indicating transmitter (PIT-401A).
(4) Position of GAC F-401 inlet flow valve (FV-401A).
(5) Position of GAC F-401 effluent flow valve (FV-401B).
(6) Position of GAC F-401 backwash inlet flow valve (FV-401C).
(7) Position of GAC F-401 backwash effluent flow valve (FV-401D).
(8) Position of GAC F-401 series configuration flow valve (FV-401E).
(9) Position of GAC F-401 carbon inlet flow valve (FV-401F).
(10) Position of GAC F-402 inlet flow valve (FV-402A).
(11) Position of GAC F-402 effluent flow valve (FV-402B).
(12) Position of GAC F-402 backwash inlet flow valve (FV-402C).
(13) Position of GAC F-402 backwash effluent flow valve (FV-402D).
(14) Position of GAC F-402 series configuration flow valve (FV-402E).
(15) Position of GAC F-402 carbon inlet flow valve (FV-402F).
(16) Position of GAC F-403 inlet flow valve (FV-403A).
(17) Position of GAC F-403 effluent flow valve (FV-403B).
(18) Position of GAC F-403 backwash inlet flow valve (FV-403C).
(19) Position of GAC F-403 backwash effluent flow valve (FV-403D).
(20) Position of GAC F-403 series configuration flow valve (FV-403E).
(21) Position of GAC F-403 carbon inlet flow valve (FV-403F).
(22) Input status of GAC F-401 outlet pressure indicating transmitter (PIT-401B).
(23) Input status of GAC F-402 inlet pressure indicating transmitter (PIT-402A).
(24) Input status of GAC F-402 outlet pressure indicating transmitter (PIT-402B).
(25) Input status of GAC F-403 inlet pressure indicating transmitter (PIT-403A).
(26) Input status of GAC F-403 outlet pressure indicating transmitter (PIT-403B).

3. Programmable Controller Subsystem Functions:

a. Control:

(1) Totalize runtime in minutes for individual GAC Units.
(2) Provide means to reset each runtime totalizer if reset function selected.
(3) Provide control of GAC System valves as follows:
If feed to GAC units is desired, open FV-400A.
If direct feed to Final pH Adjustment Tank is desired, close GAC system flow valve FV-400A and open by-pass flow valve FV-400B.
(4) Provide output indication if PIT-401 status changes.
(5) Provide output indication if PIT-402 status changes.
(6) Provide output indication if PIT-403 status changes.
(7) Provide output indication if FV-400a or FV-400B status changes.
(8) Provide output indication if FV-401A, FV-401B, FV-401C, FV-401D, FV-401E or FV-401F status changes.
(9) Provide output indication if FV-402A, FV-402B, FV-402C, FV-402D, FV-402E or FV-402F status changes.
(10) Provide output indication if FV-403A, FV-403B, FV-403C, FV-403D, FV-403E or FV-403F status changes.

b. Data Acquisition:
Monitor the following parameters:

(1) Status of flow valve FV-400A at ZSH-400A and ZSL-400A.
(2) Status of flow valve FV-400B at ZSH-400B and ZSL-400B.
(3) Status of flow valve FV-401A at ZSH-401A and ZSL-400A.
(4) Status of flow valve FV-401B at ZSH-401B and ZSL-400B.
(5) Status of flow valve FV-401C at ZSH-401C and ZSL-400C.
(6) Status of flow valve FV-401D at ZSH-401D and ZSL-400D.
(7) Status of flow valve FV-401E at ZSH-401E and ZSL-400E.
(8) Status of flow valve FV-401F at ZSH-401F and ZSL-400F.
(9) Status of flow valve FV-402A at ZSH-402A and ZSL-400A.
(10) Status of flow valve FV-402B at ZSH-402B and ZSL-400B.
(11) Status of flow valve FV-402C at ZSH-402C and ZSL-400C.
(12) Status of flow valve FV-402D at ZSH-402D and ZSL-400D.
(13) Status of flow valve FV-402E at ZSH-402E and ZSL-400E.
(14) Status of flow valve FV-402F at ZSH-402F and ZSL-400F.
(15) Status of flow valve FV-403A at ZSH-403A and ZSL-400A.
(16) Status of flow valve FV-403B at ZSH-403B and ZSL-400B.
(17) Status of flow valve FV-403C at ZSH-403C and ZSL-400C.
(18) Status of flow valve FV-403D at ZSH-403D and ZSL-400D.
(19) Status of flow valve FV-403E at ZSH-403E and ZSL-400E.
(20) Status of flow valve FV-403F at ZSH-403F and ZSL-400F.
(21) Status of pressure differential switch PDS-401.
(22) Status of pressure differential switch PDS-402.
(23) Status of pressure differential switch PDS-403.

Scale to engineering units and store in memory:

(24) GAC Unit F-401 inlet pressure, PIT-401A.
(25) GAC Unit F-401 outlet pressure, PIT-401B.
(26) GAC Unit F-402 inlet pressure, PIT-402A.
(27) GAC Unit F-402 outlet pressure, PIT-402B.
(28) GAC Unit F-403 inlet pressure, PIT-403A.
(29) GAC Unit F-403 outlet pressure, PIT-403B.

c. Interlocks:

(1) When system is in operation FV-400B may be opened if: correct password has been entered.
(2) When high pressure differential switch PDS-XXX activated: stop Equalization Tank T-200 transfer pump P-XXX.
(3) When calculated high differential pressure (where calculated differential pressure equals PIT-XXXA minus PIT-XXXB) activated and PDS-XXX not activated: stop Equalization Tank T-200 transfer pump P-XXX.

d. Alarms:

(1) FV-400A position open (ZSH-400A) or closed (ZSL-400A) fails to activate.
(2) FV-400B position open (ZSH-400B) or closed (ZSL-400B) fails to activate.
(3) GAC Unit F-401 inlet pressure (PIT-401A) high high.
(4) GAC Unit F-401 inlet pressure (PIT-401A) high.
(5) GAC Unit F-401 inlet pressure (PIT-401A) low.
(6) GAC Unit F-401 inlet pressure (PIT-401A) low low.
(7) GAC Unit F-401 output pressure (PIT-401B) high high.
(8) GAC Unit F-401 output pressure (PIT-401B) high.
(9) GAC Unit F-401 output pressure (PIT-401B) low.
(10) GAC Unit F-401 output pressure (PIT-401B) low low.
(11) FV-401A position open (ZSH-401A) or closed (ZSL-401A) fails to activate.
(12) FV-401B position open (ZSH-401B) or closed (ZSL-401B) fails to activate.
(13) FV-401C position open (ZSH-401C) or closed (ZSL-401C) fails to activate.
(14) FV-401D position open (ZSH-401D) or closed (ZSL-401D) fails to activate.
(15) FV-401E position open (ZSH-401E) or closed (ZSL-401E) fails to activate.
(16) FV-401F position open (ZSH-401F) or closed (ZSL-401F) fails to activate.
(17) GAC Unit F-402 inlet pressure (PIT-402A) high high.
(18) GAC Unit F-402 inlet pressure (PIT-402A) high.
(19) GAC Unit F-402 inlet pressure (PIT-402A) low.
(20) GAC Unit F-402 inlet pressure (PIT-402A) low low.
(21) GAC Unit F-402 outlet pressure (PIT-402B) high high.
(22) GAC Unit F-402 outlet pressure (PIT-402B) high.

(23) GAC Unit F-402 outlet pressure (PIT-402B) low.
(24) GAC Unit F-402 outlet pressure (PIT-402B) low low.
(25) FV-402A position open (ZSH-402A) or closed (ZSL-402A) fails to activate.
(26) FV-402B position open (ZSH-402B) or closed (ZSL-402B) fails to activate.
(27) FV-402C position open (ZSH-402C) or closed (ZSL-402C) fails to activate.
(28) FV-402D position open (ZSH-402D) or closed (ZSL-402D) fails to activate.
(29) FV-402E position open (ZSH-402E) or closed (ZSL-402E) fails to activate.
(30) FV-402F position open (ZSH-402F) or closed (ZSL-402F) fails to activate.
(31) GAC Unit F-403 inlet pressure (PIT-403A) high high.
(32) GAC Unit F-403 inlet pressure (PIT-403A) high.
(33) GAC Unit F-403 inlet pressure (PIT-403A) low.
(34) GAC Unit F-403 inlet pressure (PIT-403A) low low.
(35) GAC Unit F-403 outlet pressure (PIT-403B) high high.
(36) GAC Unit F-403 outlet pressure (PIT-403B) high.
(37) GAC Unit F-403 outlet pressure (PIT-403B) low.
(38) GAC Unit F-403 outlet pressure (PIT-403B) low low.
(39) FV-403A position open (ZSH-403A) or closed (ZSL-403A) fails to activate.
(40) FV-403B position open (ZSH-403B) or closed (ZSL-403B) fails to activate.
(41) FV-403C position open (ZSH-403C) or closed (ZSL-403C) fails to activate.
(42) FV-403D position open (ZSH-403D) or closed (ZSL-403D) fails to activate.
(43) FV-403E position open (ZSH-403E) or closed (ZSL-403E) fails to activate.
(44) FV-403F position open (ZSH-403F) or closed (ZSL-403F) fails to activate.

4. Supervisory Control and Data Acquisition System Functions: The Man-Machine Interface (MMI) function of the SCADA system shall display the following information:

(1) Process control loop parameters and mode.
(2) Analog values of parameters listed in paragraph 3b items 24 to 29.
(3) Display cumulative run times of individual GAC Units
(4) Display flow totalizer for individual GAC Units
(5) Display alarm indications as listed in paragraph 3d.
(6) Provide means for alarm acknowledgement.
(7) Provide operator interface to:
Select individual GAC Units;
Select individual GAC Units for backwash;
Reset run time totalizer of individual GAC Units;
(8) Provide real time trends of analog parameters listed in paragraph 3b items 24 to 29.

All Unit Process parameters listed in paragraph 3b and alarms listed in paragraph 3d shall be made available over the communication link to the host computer and the MONITROL graphical process interface software.

G. Unit Process 6 - Final pH Adjustment and Discharge (P&ID I5)

1. Overview

a. The effluent from the GAC Unit Process will enter the Final pH Adjustment Tank via a 4" carbon steel pipe. Discharge flow will be by gravity as a function of influent flow.

b. The Final pH Adjustment Unit Process shall consist of the Final pH Adjustment Tank (T-500) one mixer (A-500), two chemical addition pumps (P-520 and P-530), one level transmitter (LT-500), one flow indicating transmitter (FIT-500), and two pH probes and transmitters (AIT-500A and AIT-500B).

c. The final pH of the effluent shall be maintained within discharge limits by the addition of either a sodium hydroxide solution utilizing P-520 or sulfuric acid solution utilizing pump P-530 based on the pH measured at primary control element AIT-500A. The secondary pH control element, AIT-500B, will be used to confirm the pH value and will serve as a back-up to the primary control element. Discharge flow will be continuously monitored in the vertical leg of the discharge pipe on FIT-500. A continuous level transmitter, LT-500, shall monitor the tank level.

2. Analog Subsystems Functions:

a. Sensors/Transmitters:
Measure the following parameters and transmit digital signal to the local PCS:

(1) Level of Final pH Adjustment tank (LT-500).
(2) Final effluent flow (FIT-500).

Measure the following parameters and transmit a linearly proportional signal to the local PCS:

(2) pH of the Final Effluent as measured at the primary control element (AIT-500A).
(2) pH of the Final Effluent as measured at the secondary control element (AIT-500B).

b. Control:

(1) Input HAND and AUTO selection for agitator motor A-500 (HS-400B).
(2) Input ON selection for agitator motor A-500 (HS-500C).

(3) Input OFF selection for agitator motor A-500 (HS-500D).
(4) Input FIELD DISCONNECT status for agitator motor A-500 (HS-500A).
(5) Input status of agitator motor A-500 starts auxiliary (YY-500) at Motor Control Center (MCC) PCS.
(6) Input HAND and AUTO selection for pump motor P-520 (HS-520).
(7) Input status of pump motor P-520 power relay auxiliary (YY-520).
(8) Input HAND and AUTO selection for pump motor P-530 (HS-530).
(9) Input status of pump motor P-530 power relay auxiliary (YY-530).
(10) Input status of Sodium Hydroxide Tote level switch (LS-520).
(11) Input status of Sulfuric Acid Tote level switch (LS-530).

3. Programmable Controller Subsystem Functions:

a. Control:

(1) If AUTO selected, provide ON-OFF function to agitator motor A-500.
(2) Totalize runtime in minutes for agitator A-500.
(3) Provide means to reset runtime totalizer if reset function selected.
(4) Provide failure indication output if agitator A-500 stops running when it is supposed to be in the run state.
(5) If AUTO selected provide ON-OFF function to sodium hydroxide feed pump motor P-520.
(6) Totalize runtime in minutes for agitator P-520.
(7) Provide means to reset runtime totalizer if reset function selected.
(8) Provide failure indication output if agitator P-520 stops running when it is supposed to be in the run state.
(9) If AUTO selected provide ON-OFF function to sulfuric acid feed pump motor P-530.
(10) Totalize runtime in minutes for agitator P-530.
(11) Provide means to reset runtime totalizer if reset function selected.
(12) Provide failure indication output if agitator P-530 stops running when it is supposed to be in the run state.
(13) Provide feedback control of Final pH Adjustment Tank T-500 pH by transmitting an analog signal to the local PCS. Feedback control loop shall have two modes: MANUAL and AUTO. In AUTO, addition of either sodium hydroxide or sulfuric acid shall be delivered by activating either pump P-520 or P-530, respectively, until the pH measured at the primary control element AIT-500 equals the setpoint. In MANUAL, pump P-520 or P-530 may be activated to deliver either sodium hydroxide or sulfuric acid, respectively, until the desired pH is achieved.

b. Data Acquisition:
Monitor the following parameters:

(1) HAND and AUTO selection indication for agitator A-500 (HS-500B) and pumps P-520 and P-530 (HS-XXX).
(2) ON selection for agitator A-500 (HS-500C).
(3) OFF selection for agitator A-500 (HS-500D).
(4) FIELD DISCONNECT status for agitator A-500 (HS-500A).
(5) Power relay status for pumps P-520 and P-530 (YY-XXX).

Scale to engineering units and store in memory:

(6) Final pH Adjustment Tank, LT-500.
(7) Final effluent flow, FIT-500.

c. Interlocks:

(1) Stop either P-210 or P-211 if: AIT-500A low low.
(2) Stop either P-210 or P-211 if: AIT-500A high high.
(3) Stop either P-210 or P-211 if: AIT-500B low low.
(4) Stop either P-210 or P-211 if: AIT-500B high high.
(5) Stop either P-210 or P-211 if: LT-500 high high.

d. Alarms:

(1) Final effluent pH (AIT-500A) high high.
(2) Final effluent pH (AIT-500A) high.
(3) Final effluent pH (AIT-500A) low.
(4) Final effluent pH (AIT-500A) low low.
(5) Final effluent pH (AIT-500B) high high.
(2) Final effluent pH (AIT-500B) high.
(3) Final effluent pH (AIT-500B) low.
(4) Final effluent pH (AIT-500B) low low.

4. Supervisory Control and Data Acquisition System Functions:
The Man-Machine Interface (MMI) function of the SCADA system shall display the following information:

(1) Process control loop parameters and mode.
(2) Mode and status pumps P-520 and P-530.
(3) Analog values of parameters listed in paragraph 3b items 6 and 7.
(4) Display cumulative run times of agitator motor A-500 and pumps P-520 and P-530.
(5) Display alarm indications as listed in paragraph 3d and provide means for alarm acknowledgement.
(6) Provide operator interface to:
Activate ON-OFF function to agitator A-500 and pumps P-520 and P-530;
Change Final pH Adjustment Tank control loop parameters and mode;

Reset run time totalizer of agitator A-500 and pumps P-520 and P-530;

(8) Provide real time trends of analog parameters listed in paragraph 3b items 6 and 7.

(9) Provide real time trend of pH control loop output.

All Unit Process parameters listed in paragraph 3b and alarms listed in paragraph 3d shall be made available over the communication link to the host computer and the MONITROL graphical process interface software.